



# SAN FRANCISCO CLEAN WATER PROGRAM



## **Lake Merced and Richmond Transport Storage Facilities Plan**

**December 1988**

**(Revised July 1990)**

### **VOLUME I**

**(SEE ALSO VOL.II - ADDENDUM RE:  
RICHMOND TRANSPORT JULY 1990)**

**SUBMITTED BY  
CITY AND COUNTY OF SAN FRANCISCO  
DEPARTMENT OF PUBLIC WORKS  
CLEAN WATER PROGRAM**



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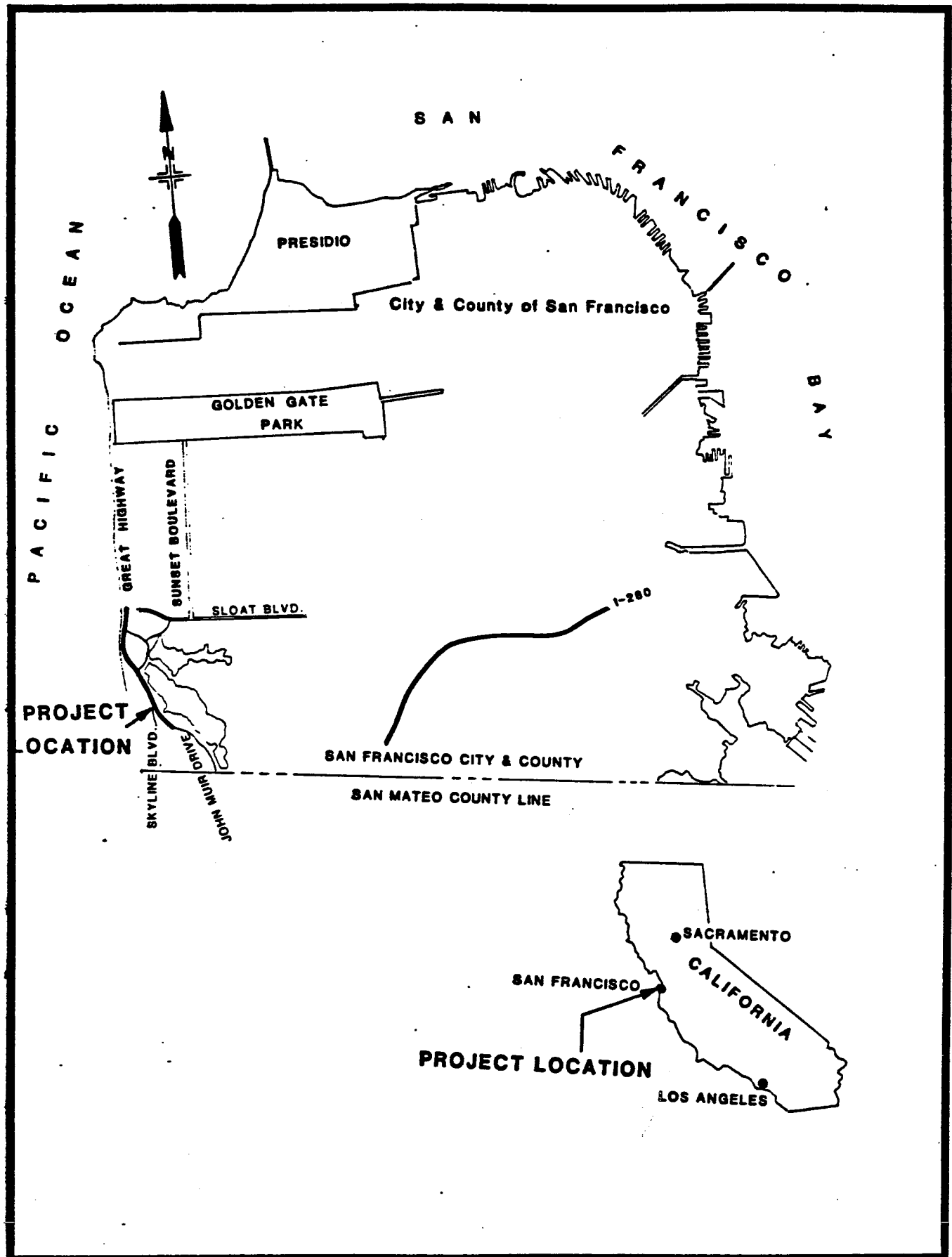
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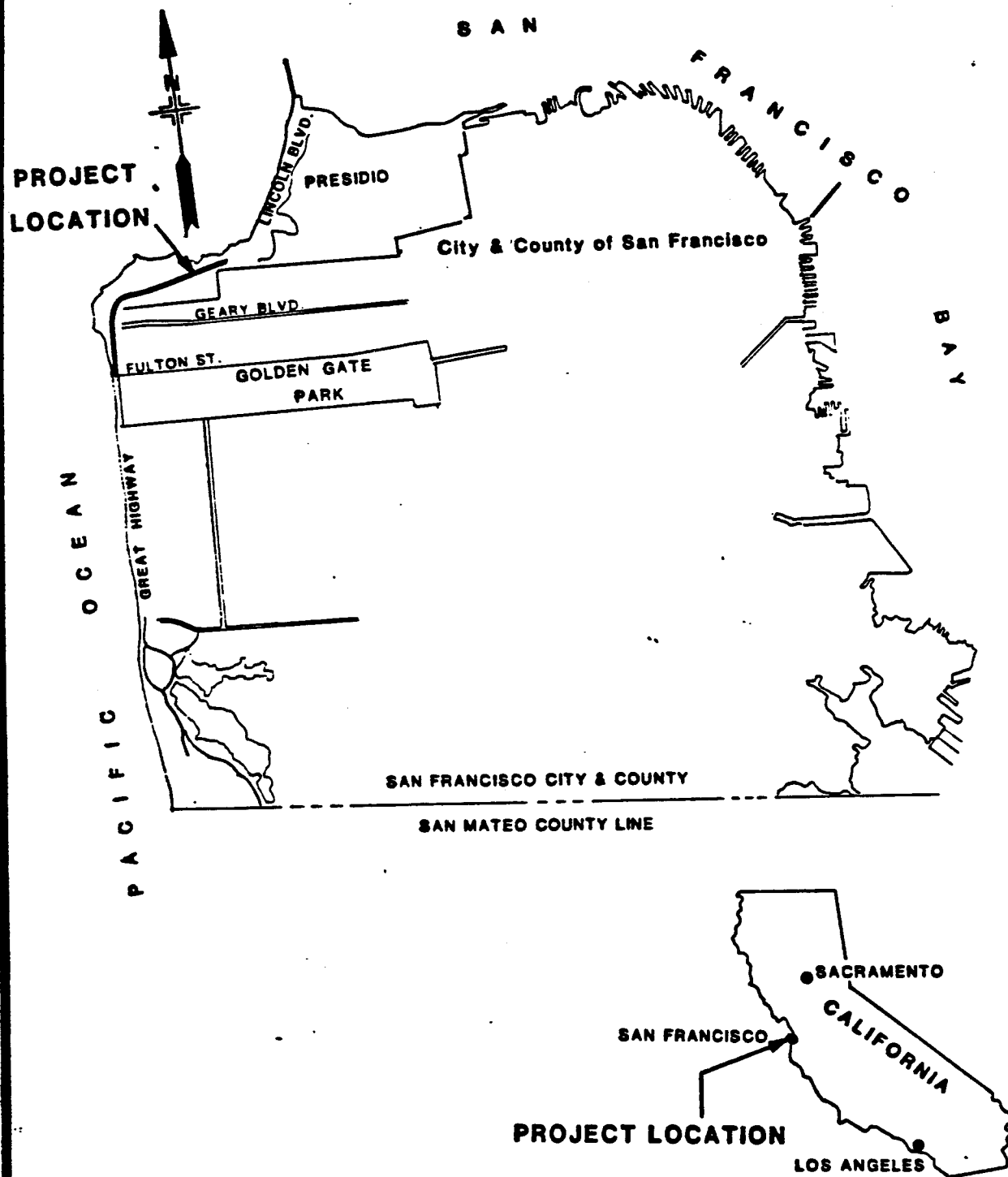
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**LAKE MERCED TRANSPORT LOCATION MAP**



**RICHMOND TRANSPORT LOCATION MAP**

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## **CHAPTER 1**

### **INTRODUCTION**

San Francisco operates three water pollution control plants. Two of these plants, Southeast and Richmond Sunset, operate during dry and wet weather, and the third, North Point, operates only during periods of wet weather. The City has a combined sewer system consisting of a single network of pipes collecting both domestic sewage and storm drainage. About 95 percent of the City's rainfall occurs during the wet weather months of October through April.

During rainy periods combined flows of sanitary wastes and stormwater inflow often exceed water pollution control plant capacity. In the past, when this occurred, a major portion of the combined wastewater flows bypassed the treatment plants and were discharged untreated into the San Francisco Bay and the Pacific Ocean. This amounted to approximately 6.0 billion gallons of untreated wastewater being bypassed up to an average of 58 times per year.

The Federal Water Pollution Control Act of 1972 required that all sewage treatment plants be upgraded to secondary level to remove 85 percent of pollutants. In order to meet this requirement as well as Federal and State regulations and discharge requirements, the City and County of San Francisco embarked on a massive program to upgrade its water pollution control facilities. Concurrently, construction of facilities to reduce and treat combined sewer overflows was begun. Direction of this effort is the responsibility of the San Francisco Department of Public Works' Clean Water Enterprise.

### **BACKGROUND**

The City's Water Pollution Control Master Plan, prepared in 1971 and subsequently updated, proposed the construction of the following facilities (listed in historic order):

North Shore Outfalls Consolidation (NSOC) - construction completed  
North Point Crosstown and Pump Station - construction completed  
Channel Outfalls Consolidation (COC) - construction completed  
Islais Creek Outfalls Consolidation (ISOC) - planned  
Bayside Wet-Weather Transport - planned  
Westside Transport (WST) - construction completed  
Richmond and Lake Merced Transports - planned  
Southwest Ocean Outfall (SWOO) - construction completed  
Southeast Water Pollution Control Plant (SEWPCP) - construction completed  
Southwest Water Pollution Control Plant (SWWPCP) - planned  
Crosstown Transport - planned

Yosemite Transport Storage and Pump Station - under construction  
Channel/Islais Tunnel - planned  
Sunnydale Transport Storage and Pump Station - designed

The expanded SEWPCP has been in service since August 1982. The plant provides secondary treatment for an average dry weather flow of 85mgd. Planning for the SWWPCP was based on treating an average dry weather flow of 22 mgd to primary or secondary levels depending on the results of the City's application for a 301(h) Ocean Waiver, and whether the project will include the conveyance of SEWPCP secondary effluent to blend with the SWWPCP effluent. In addition, the SWWPCP was to treat a total peak wet weather flow of 450 mgd. According to the City's Master Plan, the existing Richmond-Sunset plant would eventually be phased out and Westside dry weather flow would be treated at the Southwest site.

In 1982 the City proposed a two-core system as an interim stage for implementation of the City's Master Plan (see Figure 1-1). The proposed two-core system consisted of the Bayside Core System and the Westside Core System. Upon completion of the two-core system, the City would attain 93 percent of the environmental benefits ascribed in the City's Master Plan at a cost less than the \$2.3 billion estimated in the original 1980 plan.

The Bayside Core System contributes about 76 percent of the City's combined sewage flow; \$464 million has been spent to upgrade the sewerage facilities, some of which have been in operation since 1982. The Bayside Core System consists of:

- o Northshore Outfalls Consolidation and Pump Station, which reduced untreated overflows from the Oakland-Bay Bridge to the Golden Gate Bridge to an average of four overflows per year.
- o North Point Water Pollution Control Plant, which operates as a primary treatment plant for wet-weather flows.
- o Channel Outfalls Consolidation and North Point Crosstown Transport and Pump Station, which reduced untreated overflows from Islais Creek to the Oakland-Bay Bridge to an average of 10 overflows per year and pumps all dry weather flows from the northeastern part of the City to the SEWPCP.
- o Southeast Water Pollution Control Plant, which provides secondary treatment to all bayside dry-weather flows.

- o Hunter's Point Facilities, which were completed in 1986, the Griffith Pump Station and Yosemite Facilities, which are under construction, and the Sunnydale facilities whose design has been completed, will reduce wet weather overflows south of Islais Creek to an average of one per year.

The Bayside Core System provides secondary treatment to all Bayside dry weather flows at the SEWPCP. With the completion of the expansion work at the SEWPCP, a total primary treatment capacity of up to 350 mgd is now available for wet weather flows at the SEWPCP and the NPWPCP. When the Bayside Core System storage and treatment capacities are exceeded, overflows are treated within a system of baffled chambers prior to discharge into San Francisco Bay.

The Westside Core System contributes approximately 24 percent of the City's total combined sewage flow. The cost to date for this system is \$343 million. Some elements of the system which have been operational since 1986, are as follows:

Westside Transport (WST), which has reduced the combined sewer overflows to Ocean Beach from an average of 58 to an average of 8 overflows per year.

Westside Pump Station (WSPS), which pumps wet weather flows to the SWOO and dewateres the WST after wet weather periods conveying the flow to the Richmond Sunset Water Pollution Control Plant (RSWPCP).

Southwest Ocean Outfall (SWOO), a 4-1/4-mile-long outfall, which discharges the treated effluent and decanted wet weather flow to the Pacific Ocean.

Westside Activation Components, which make use of the WST and the WSPS to reduce the number of untreated overflows to Ocean Beach by using the WSPS to convey decanted wet-weather flows to SWOO and to dewater and flush the WST after a storm.

#### **WHAT REMAINS TO BE DONE**

Several projects on both sides of the City remain to be constructed to complete the Wastewater Master Plan. Each is in either planning and design; their current status is as follows:

##### **Bayside**

- o The Sunnydale Storage/Transport Facility would collect and hold dry weather and wet weather flows in the southeast part of the City until they can be transported to the SEWPCP for treatment. Approval of the Sunnydale environmental documentation was received in December 1987; construction began in September 1989 and is scheduled to be completed in October 1991.

- o The Mariposa/Islais Creek Storage/Transport Facilities are two elements of the Bayside System which would collect and hold dry weather and wet weather flows between the Central Basin and Islais Creek Channel until they can be transported for treatment and ultimate disposal. Planning for these facilities began in Spring 1987; bids were received in July 1990.
- o The Bayside Phase 3 project will investigate options for the best site and process for treating Bayside wet-weather flows and the best site for ultimate disposal of both dry-weather and wet-weather effluents (crosstown conveyance or new bay outfall). Planning and environmental analysis began during the summer of 1987. Environmental documentation is expected to be completed late 1989.

#### **Westside**

- o The Oceanside Water Pollution Control Plant will provide wastewater treatment facilities required to meet Federal and State water quality requirements for the westside of the City. The Facilities Planning Report and environmental review documentation were completed in 1988; construction began in February 1990 and is scheduled to be completed in mid 1993.
- o The Lake Merced Transport would collect and store wet weather flows from the southwest part of the City. These flows would be delivered to the WST for transmission to SWWPCP for ultimate disposal. Planning and environmental analysis will be completed in 1988.
- o The Richmond Transport would collect and store wet weather flows in the Richmond and Seacliff areas and transport the combined flow to the WST for delivery to SWWPCP. Environmental studies were completed in June 1990.

#### **PREVIOUS REPORTS**

The reports reviewed as part of the Westside wet weather flows investigations are summarized below.

San Francisco Wastewater Master Plan, September 1971

The San Francisco Department of Public Works prepared a Master Plan for managing the City's wastewater flows. For treatment of the Westside flows, the plan recommended that a single treatment plant be built at the Lake Merced site. This plan would provide secondary treatment for the dry weather flows and primary treatment for the wet weather flows in accordance with the U. S. Environmental Protection Agency's (EPA) discharge requirements. Sludges generated at the Westside plant were to be transported via a crosstown conveyance system to the expanded (SEWPCP) for treatment and disposal. Treated effluent would be discharged to the ocean through a new outfall.

#### **Overview Facilities Plan, August 1975**

The Overview Facilities Plan was prepared by J.B. Gilbert & Associates for the San Francisco Department of Public Works. Two major treatment facilities were proposed in the report. Expansion of the existing SEWPCP to include secondary treatment facilities would provide treatment of all Bayside dry weather flows. A plant at the Lake Merced site would provide secondary treatment of Westside dry weather flows and advanced primary treatment of Citywide wet weather flows. Effluent disposal for both the SEWPCP and the Southwest treatment plant would be through a proposed ocean outfall adjacent to the Lake Merced site.

#### **Southwest Water Pollution Control Plant Project, Final Project Report, February 1980**

The Southwest Water Pollution Control Plant Project Report was prepared by Metcalf & Eddy Engineers for the San Francisco Department of Public Works. Metcalf & Eddy, in conjunction with the City staff, developed four basic master plans with options. Each master plan was examined for technical feasibility at three levels of overflow control: one, two, and four overflows per year.

The apparent best alternative was Master Plan 1B, which involved construction of a Southwest plant, along with a crosstown tunnel which would transport both North Shore and Southeast wet weather flows to the Southeast plant. Of the four possible sites available for the Southwest plant (Lake Merced site, Harding Park site, Golden Gate Park site and Fort Funston site), the Lake Merced site was chosen as the best potential site. The plant was initially designated as a primary treatment plant as the City has requested a waiver of secondary treatment requirements from the EPA. Provisions were made in the design for future upgrading to secondary treatment using rotating biological contactors (RBC's). Effluent disposal was to be through a proposed ocean outfall adjacent to the Lake Merced site.

## **Bayside Facilities Plan Crosstown Project Report. March 1982**

The Bayside Facilities Plan presented a detailed description of a crosstown project alternative (alternative 351-A1). This alternative involved the construction of 44,000 feet of 66 inch diameter steel pipe through a route that is 95 percent in public rights-of-way. Wastewater flows from the Bayside of the City would be conveyed to the ocean for disposal using open-cut construction. The alternative also involved the construction of a crosstown pump station on 3.5 acres of land near the head of Islais Creek. The crosstown conveyance alternatives will be investigated further later this year.

## **Richmond-Sunset Water Pollution Control Plant Improvements, Draft Planning Report, May 31, 1985**

The objective of this report was to identify the apparent best alternative for the interim improvements at the RSWPCP necessary to comply with the State Ocean Plan requirements. Seven project alternatives were selected for analysis.

## **Westside Water Pollution Control Facility Planning Report, January 22, 1988**

The objective of this report was to determine wastewater treatment facilities required to meet Federal and State water quality requirements for the Westside of the City and to determine the actual location of these facilities.

The apparent best alternative (ABA) was construction of a new treatment facility consisting of pre-treatment, primary treatment, high purity oxygen activated sludge secondary treatment and solids handling facilities at a site south of the zoo and west of Lake Merced. Under this aba, the RSWPCP will be abandoned and the site in Golden Gate Park will be returned to the Recreation and Park Department for park use.

## **PURPOSE OF PROJECT REPORT**

The purpose of this project report is to develop alternatives and recommendations for the collection and transport of combined sewage and surface runoff in the Lake Merced drainage area and in the upper Richmond and Seacliff neighborhoods to comply with federal and state law.

This report is written to comply with Clean Water Grant funding requirements pursuant to Public Law 92-500 (the Federal Water Pollution Control Act of 1972 as amended by Public Law 95-217, Clean Water Act of 1977 and by Public Law 95-117, the Clean Water Act of 1981 (and the 1987 amendments), and the State Water Bond Law of 1970.

## **SCOPE OF THE REPORT**

The scope of the project report, listed by chapter, is as follows:

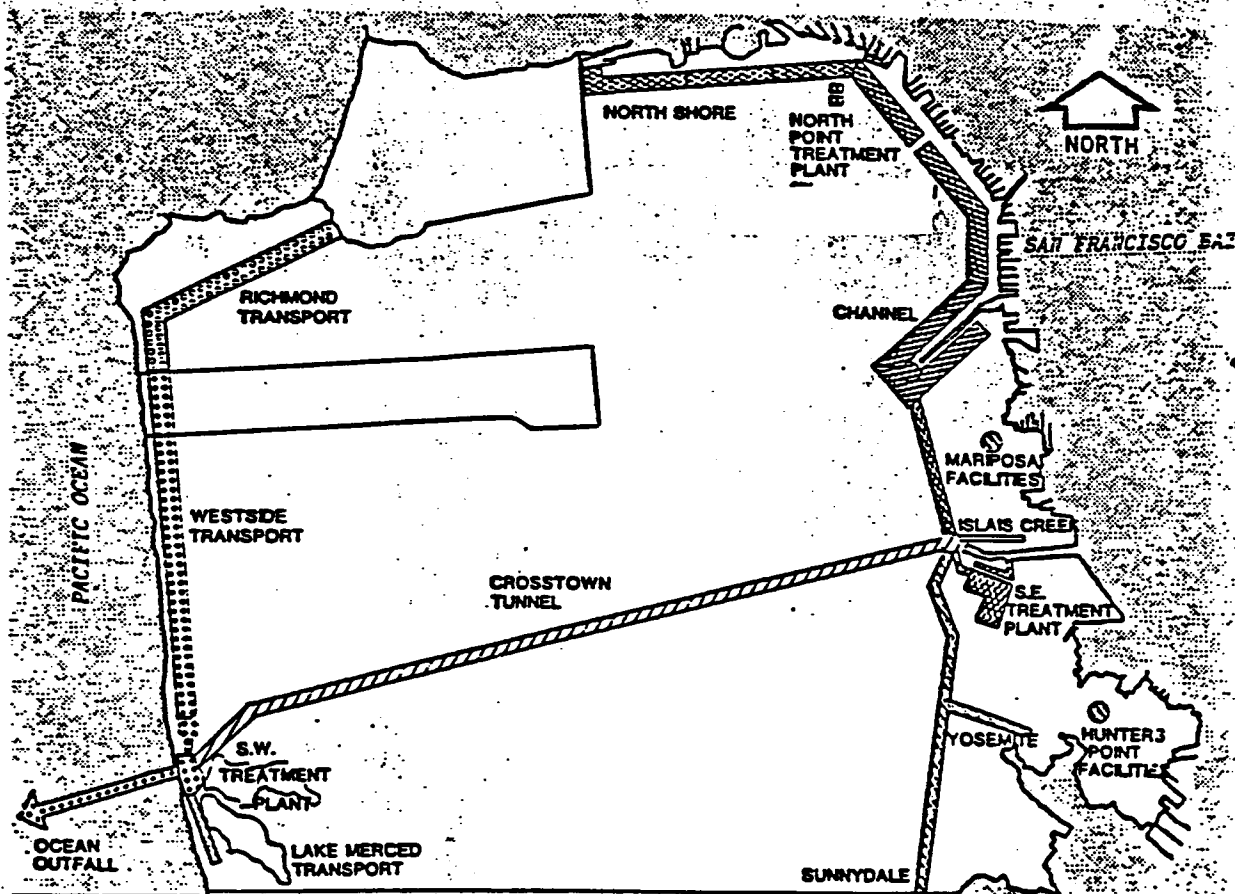
1. Introduction
2. Summary of project report
3. Review of the project service area, including geographic setting, hydrology, land use, economic activity, population, climate, air quality, and environmental setting.
4. Review of water supply and wastewater generation, including the water supply system, water use, and wastewater flow; statistical analysis of the existing wastewater characteristics during dry weather and wet weather months; and projected dry weather and wet weather influent loadings.
5. Review of the existing Westside facilities, including treatment plant in terms of historical development, treatment processes, operation, performance, plant effluent quality and discharge compliance record; collection system configuration.
6. Review of the Federal and State discharge requirements.
7. Development of alternatives and initial screening and selection.
8. Analysis and selection of the apparent best alternative.
9. Presentation of the apparent best project alternative, including a description of dry weather and wet weather operation concepts, design criteria, construction methodology, and operation and maintenance requirements, a time schedule, and a financial plan.







## **PLANNING OBJECTIVES AND GOALS**

The primary objective of this planning report is to choose an alternative that best meets the requirements for reducing wet weather overflows for the study area.

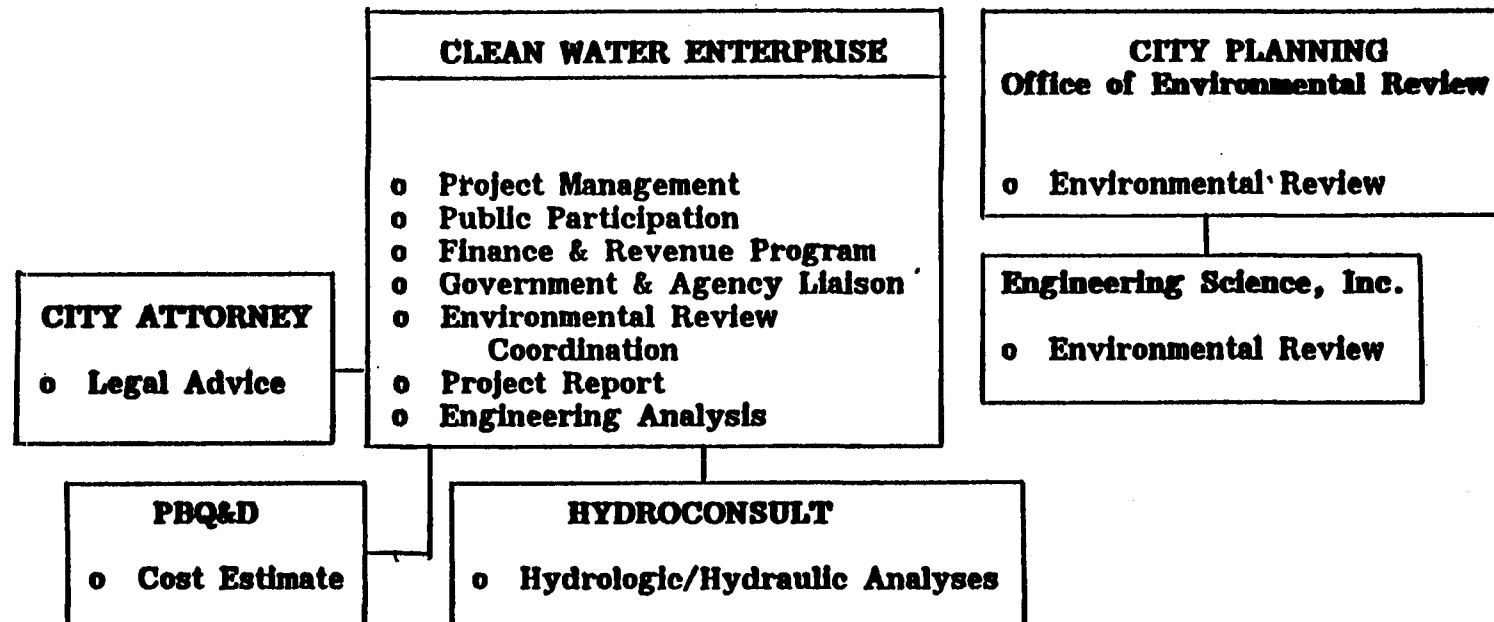


Figure 1-1.  
TWO CORE PLAN — INTERIM MASTER PLAN IMPLEMENTATION

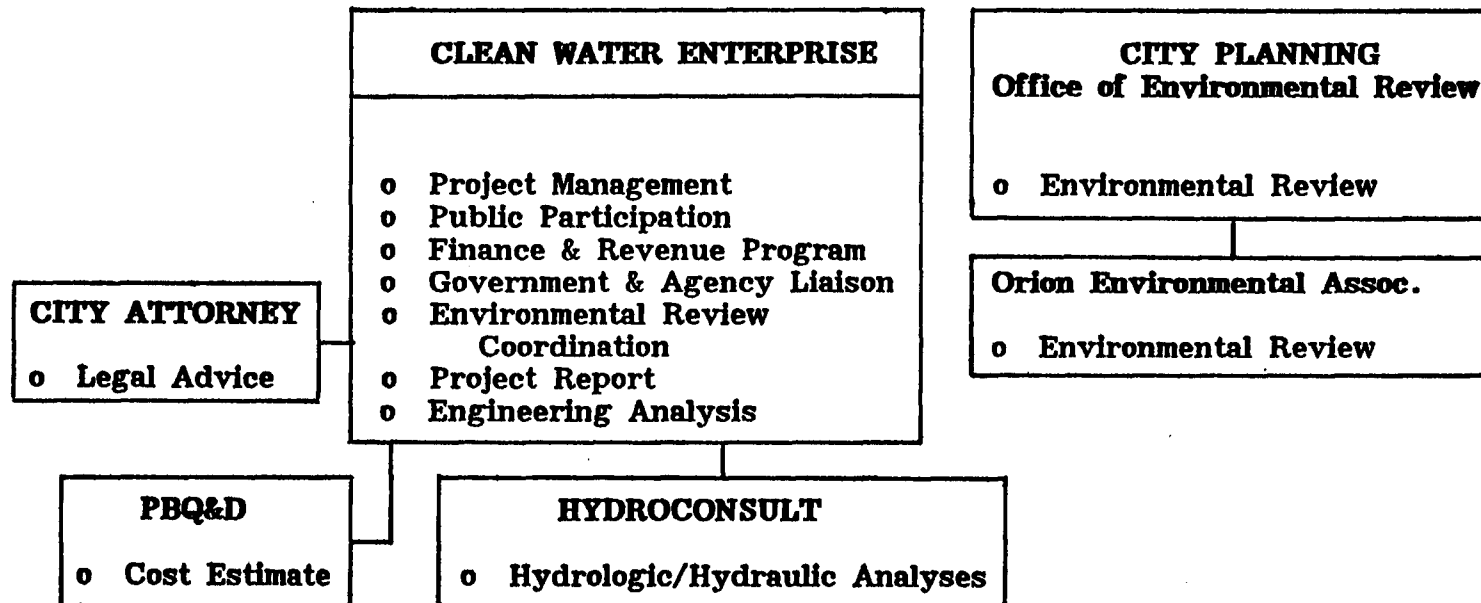


-  Bayside Core - became operational in 1982.
-  Westside Core - became operational in 1986.
-  Southwest Water Pollution Control Plant - construction period 1989 to 1992.
-  Remainder of Bayside Facilities - construction scheduled for completion in 1993.
-  Crosstown Transport - in preplanning stage. Funding has not been determined.
-  Richmond and Lake Merced Transports - Funding has not been obtained. Projected construction period 1991 to 1994.

**FIGURE 1-2**  
**LAKE MERCED PROJECT PLANNING REPORT**  
**FACILITIES PLANNING STUDY TEAM**



**FIGURE 1-2a**  
**RICHMOND PROJECT PLANNING REPORT**  
**FACILITIES PLANNING STUDY TEAM**



## **CHAPTER 2**

### **SUMMARY AND RECOMMENDATIONS**

This chapter summarizes major aspects of the Lake Merced Transport and Richmond Transport projects and recommendations for the Lake Merced Project. Work on the Richmond Project recommendations and environmental review has been delayed pending the outcome of discussions with federal agencies whose property is needed for certain options. The order of presentation coincides with the sequence of chapters in the body of this project report. An environmental review document is being prepared concurrently. Upon completion, the project report and the environmental review document will complete the facilities planning phase of the Lake Merced project.

### **EXISTING AND PROJECTED SERVICE AREA CHARACTERISTICS**

San Francisco is located at the northern end of a peninsula consisting of a cluster of hills, which form part of the coastal mountain range. Although San Francisco is commonly known as the City built on seven hills, actually there are dozens of peaks of various heights. The Twin Peaks, near the geographic center of the City, are the highest points at 922 feet above sea level. From Twin Peaks, the land slopes steeply to the Pacific Ocean on the west and the San Francisco Bay on the north, and toward a flat coastal strip along the east side of the City. San Francisco has approximately 24 miles of shoreline, two-thirds of which is bounded by the Bay. The average annual rainfall in San Francisco is approximately 20 inches with 84 percent usually falling between November and March. The winds in the City blow mostly in a westerly direction.

Principal commercial and industrial development is located in the eastern half of the City. Shipping and fishing industries predominate the Bay shorelines with tourist attractions concentrated in the northeastern quadrant.

For the purpose of this study, the dry weather service area is restricted to the Westside, including the Richmond, Sunset and Lake Merced Districts. This service area is primarily residential with large areas of parks and other public lands (e.g., Golden Gate Park, Lincoln Park, Harding Park, Lake Merced, Baker's Beach, Phelan Beach, Ocean Beach [which runs from the Cliff House to Fort Funston], Fort Funston, the San Francisco Zoological Gardens, and Stern Grove).

The San Francisco Zoological Gardens are located northwest of Lake Merced. Lake Merced, a natural freshwater recreation lake, is surrounded by a freshwater marshland that supports a variety of birdlife and vegetation.

The current land use in the service area is as follows:

| Use               | Area, acres   |
|-------------------|---------------|
| Public            | 3,027         |
| Street & Highways | 2,605         |
| Industrial        | 280           |
| Commercial        | 1,030         |
| Residential       | 4,393         |
| <b>TOTAL</b>      | <b>11,335</b> |

In the service area, 88 percent of the acreage is either residential or public lands. This area is economically stable and is expected to remain primarily residential throughout the planning period (from 1990 through 2010). Population data compiled by the Association of Bay Area Governments (ABAG, 1987) indicates that the future population of the service area will increase by 2 percent from 229,666 to 234,066 during the planning period.

The service area has frequent fog and low clouds, but few days of extreme temperatures. The average daily temperature ranges from a low of 45 F in January to a high of 69 F in September. The Bay Area has experienced serious air quality problems; however, San Francisco has relatively clean air because of the predominantly westerly winds that constantly blow fresh ocean air over the City. Project impacts on air quality will be primarily construction-related and subject to control through mitigation.

#### **WATER AND WASTEWATER CHARACTERISTICS**

San Francisco receives most of its water supply from reservoirs in the Sierra Nevada Range via an aqueduct system. The City's Water Department manages the distribution and sale of water to both domestic and industrial customers within San Francisco and to cities along the peninsula. In 1985, the domestic water use within the City averaged about 100 gallons per capita per day (gpcd). The population and domestic water consumption for the service area is not projected to increase significantly through the year 2010. Therefore, the water consumption rates are assumed to be the same as the Citywide rate. Well water is used for seasonal irrigation in some parks in the District.

The proposed Lake Merced and Richmond facilities will have very little effect on Citywide water use. The projects, in most respects, maintain the existing collection system under City control, creating no impetus for expansion of service to new areas.

#### **Westside Dry Weather Flows**

The existing average dry weather wastewater flow conveyed from the Westside to the RSWPCP for treatment is 21 million gallons per day (mgd). This flow is primarily domestic sewage with only small volumes (averaging about 7 percent) of industrial wastewater. The wastewater characteristics are typical for domestic sewage. Currently, the sludge generated by treating these flows is dewatered onsite and hauled to a landfill.

The Westside average dry weather flows and loadings are expected to remain constant through the planning period.

#### **Westside Wet Weather Flows and Loadings**

The wet weather flows and loadings for the RSWPCP are summarized below:

|                                      |     |
|--------------------------------------|-----|
| Maximum Flow, mgd                    | 43  |
| Total Suspended Solids (TSS), mg/l   |     |
| Average (50 percentile)              | 170 |
| Maximum (95 percentile)              | 250 |
| Biological Oxygen Demand (BOD), mg/l |     |
| Average (50 percentile)              | 180 |
| Maximum (95 percentile)              | 240 |

#### **Infiltration/Inflow**

In 1974, the City evaluated stormwater infiltration/inflow (I/I) to the sewer system of the service area. The results of the study indicated that the I/I was not excessive, and it was concluded that transporting and treating the I/I is more practical and economical than correcting any defects in the sewer system.

## **EXISTING WASTEWATER TREATMENT FACILITIES**

The City of San Francisco currently operates and maintains three major water pollution control plants: The North Point, Southeast, and Richmond-Sunset Water Pollution Control Plants, referred to as the NPWPCP, SEWPCP, and the RSWPCP, respectively. The first two plants handle all the flow from the Bayside of the City.

The RSWPCP has been in service since 1939 and is the oldest of the three plants. This plant provides primary treatment for all dry-weather flows from the Westside of the City. The average dry weather flow to the RSWPCP is approximately 21 mgd. Wet weather flow in excess of the plant treatment capacity (43 mgd) is diverted to the Westside Transport (WST) box for storage. The transport box includes two major chambers called east and west boxes. The excess influent to the RSWPCP initially flows into the WST east box. If the wet weather flow is in excess of the maximum available storage capacity of the east box, the sewage is decanted to the west box via a decanting slot which keeps settled solids in the east box. In addition, a baffle in front of the slot keeps floatables from entering the west box. During a storm, decanted flow from the west box is pumped to the Southwest Ocean Outfall (SWOO) via the WSPS. Once the storm subsides, the flow stored in the east box is pumped by the WSPS to the RSWPCP for treatment. After the WST box has been emptied, it is cleaned by flushing with effluent from the RSWPCP. The effluent used for flushing is returned to the RSWPCP for treatment. If the wet weather flow is in excess of the maximum storage capacity of the west box, the combined sewage overflows to the Vicente and Lincoln Way outfalls.

The RSWPCP treatment processes include: screening, grit removal, primary sedimentation, chlorination, dechlorination, solids digestion, and dewatering. The 54 inch plant effluent pipeline parallels the WST box to the SWOO. The SWOO discharges about 4.5 miles offshore, approximately 76 feet below mean lower low water. The Mile Rock Sewer would be used as an emergency bypass line in the event the SWOO becomes inoperative. The sludge, after anaerobic digestion and dewatering, is disposed of, along with the screenings and grit, at a landfill site.

The City is rehabilitating existing facilities so the plant can operate reliably and treat Westside flows until the new Oceanside facility is completed. Modifications to the grit, screenings, and scum removal facilities, primary sludge pumping to the digesters, and digested sludge dewatering are included.

## **ANALYSIS OF EXISTING SEWERAGE FACILITIES:**

### **DRY WEATHER (DW) SYSTEM CONFIGURATION**

#### **Lake Merced Transport Service Area**

The Lake Merced drainage basin consists of the projected sewage area of 2387 acres, of which 1645 acres are presently sewered (see Figure 2-1). It is located in the southwest corner of the City and includes approximately 150 acres south of the County line. It drains naturally in a general westward direction towards the Pacific Ocean.

Currently, dry weather (DW) flows from the higher elevations, approximately 1000 acres located generally east of 19th Avenue, are intercepted by small northward flowing sewers and directed outside the Lake Merced area to a point on Eucalyptus Street where they join other flows and follow a northerly route to the Richmond-Sunset Water Pollution Control Plant (RSWPCP). DW flow from the Stonestown Shopping Center and the northern two thirds of San Francisco State University are led into the northward flowing sewers noted above. DW flow from the remainder of the Lake Merced area enters a large trunk sewer which follows first a southerly and subsequently a general westerly direction and is directed to the Lake Merced Pump Station (LMPS). Here, the LMPS pumps the DW flow in a general northerly direction to a 48" gravity sewer which carries these flows into the lower Vicente area outside the Lake Merced watershed. Eventually, these flows join with other flows and are directed northward to the RSWPCP for treatment.

#### **Richmond Transport Service Area**

The existing sewerage scheme basically takes the sewage from the higher elevations in the eastern half of Richmond drainage area and directs it into the Lake St. sewer collector. The Lake Street sewers go through three diversion structures at 17th, 22nd, and 24th Avenue and pick up additional sewage from Seacliff area, Presidio and Lincoln Park as it goes to a westerly direction. The dry weather (DW) flow enters the sewer tunnel which begins at 24th Avenue and Lake Street and cuts through the Richmond area diagonally to Fulton Street & 35th Avenue. From this point, the flow continues westerly and to a diversion structure at 41st Avenue. At 46th Avenue, this flow joins other flows from the lower part of Richmond area and go into the Richmond-Sunset Water Pollution Control Plant in Golden Gate Park for treatment.



## **WET WEATHER (WW) SYSTEM CONFIGURATION**

### **Lake Merced Transport Service Area**

When rainfall intensity exceeds 0.02 inches per hour for a period of time, the designed capacity of the dry weather sewerage would be exceeded. Combined flows from the upper 1000± acres in excess of the limited capacity (15± mgd) of the northward flowing DW interceptors flow westward via large sewers and join with WW flows from the lower Lake Merced area. The combined flow follows the same route as the DW flow to the LMPS which pumps up to 6.7 mgd northward into the Vicente watershed. Flows in excess of 6.7 mgd overflow a low weir just downstream of the inflow to the LMPS and discharge into the Pacific Ocean via the Lake Merced outfall tunnel under Fort Funston.

### **Richmond Transport Service Area**

When rainfall intensity exceeds .02 inches per hour for a period of time, the designed capacity of the dry-weather sewerage would be exceeded. Under these conditions, the diversion/control structures on Lake Street at 17th and 22nd Avenues divert the excess flows into 6.5' and 5.0' diameter outfall conduits flowing northerly to Baker Beach. Remaining flows will move westward into the diversion structure at 24th Avenue and Lake Street.

At the same time, combined flows originating from the central Richmond area including Lincoln Park and flows from the diversion structure at 22nd Avenue drop into the sewer tunnel. Excess flows continue the 6' diameter sewer which transports the flows into the diversion structure at Seacliff Avenue and 26th Avenue. At the same time, flows from Pump Station No. 1 and flows from most of the Seacliff area merge together at the diversion structure. Excess flows continue northward and are discharged at Phelan Beach with the rest of the flows going into Pump Station No. 2. The eight acre area east of P.S. No. 2 has three overflow points. These overflows are discharged at Phelan Beach when the pump station capacity is exceeded. A 15-inch diameter overflow is also located at the sump area of the pump station to prevent the pump station from flooding. All the combined flows at the Pump Station No. 2 are discharged into the sewer tunnel at Lake Street and 25th Avenue. Combined flows reaching the tunnel are transported down to 48th Avenue and Fulton Street for overflow to the Mile Rock sewer tunnel when the capacity of the Richmond-Sunset Plant is exceeded.

## **WASTE DISCHARGE AND TREATMENT REQUIREMENTS**

The degree of treatment required is determined by the discharge standards set for protection of beneficial uses of the receiving waters. Beneficial uses identified by the Regional Water Quality Control Board (RWQCB) in the vicinity of the RSWPCP effluent discharge point include water recreation, wildlife habitat, preservation of rare and endangered species, marine habitat, fish migration and spawning, navigation, and commercial and sport fishing.

The existing discharge permit recognizes the unique characteristics of San Francisco's combined wastewater system. Separate requirements are provided for dry weather flows, wet weather flows, and integrated overflows from the diversion structures located around the City's perimeter.

### **Wet Weather Discharge Requirements**

The current wet weather discharge permit requires that the City provide facilities to reduce combined sewer overflows to provide for a long-term average of eight overflows annually through the existing diversion structures along the shoreline within the service area. (Order No. 76-23 and 79-12, NPDES Permit No. 0038415, Appendix A). This is a reduction from the previous 58 overflows per year.

One of the requirements for a justifiable overflow is that the "City-wide treatment facilities are operated at capacity or some lower rate consistent with the maximum withdrawal and transport rates." Operating limits will be established during actual wet weather conditions to prevent plant upsets during a storm or dewatering and flushing of the WST facilities. It is expected that the Westside wet weather discharge will meet Federal and State Ocean Plan standards provided the SWRCB's exemption from the 75 percent suspended solids removal requirements will remain in effect and the WST box will perform as a primary sedimentation basin in terms of TSS and grease and oil (G/O) removal efficiencies. Additional wet weather primary treatment facilities will have to be constructed if these assumptions are not substantiated during initial operation. At present, data is being collected and analyzed to determine the efficiency of the WST box. Bayside overflow data for 1984-85, 1985-86 and 1986-87 rainy seasons indicate that removal efficiencies of the North Shore transport box for wet weather TSS and G/O are at least equivalent to those achieved through primary sedimentation.

## **Waiver of Secondary Treatment Requirements**

In accordance with the provisions of Public Law 95-217 (Clean Water Act of 1977), the City filed a request for a waiver of secondary treatment requirements for the proposed Westside dry weather facility on September 13, 1979. The 1977 Act permitted applicants to file such a waiver with the concurrence of the SWRCB. The Act also permitted the EPA to issue a National Pollution Discharge Elimination System (NPDES) Permit modifying secondary treatment requirements under certain circumstances.

Subsequently, in February 1990, the City withdrew its waiver application. A revised NPDES permit (Order 90-093), adopted by the Regional Water Quality Control Board (RWQCB) at a June 20, 1990 joint EPA/Regional Board hearing reflected full secondary treatment requirements.

## PROJECT ALTERNATIVE ANALYSIS

Major aspects addressed in this report for the Lake Merced Project include conformance with identified constraints, cost effectiveness, monetary cost, environmental impacts, social impact, scarce resources, flexibility and reliability, ability to implement, land use, and public acceptability. For the Lake Merced area project, the tunnel alternative is recommended, after comparison with the use of a retention basin in conjunction with expansion of the existing Lake Merced Pump Station. The Richmond area alternatives are described in detail in Volume II of this report.

## PROJECT COSTS AND IMPLEMENTATION

The estimated present net worth project costs for the apparent best alternative are:

**TABLE 2-1  
ESTIMATED COST OF LAKE MERCED  
TRANSPORT/STORAGE FACILITY  
ALTERNATIVE LM-3**

| ITEM NO. | DESCRIPTION                      | COST (MILLION\$) |
|----------|----------------------------------|------------------|
| 1A       | Structures                       | 20.95            |
| 1B       | Mechanical & Electrical          | .45              |
| 1        | Structures & Mechanical & Elect. | 21.40            |
| 2        | Contingency (20%)                | 4.28             |
| 3        | Professional Services (16%)      | 3.42             |
| 4        | Subtotal                         | 29.10            |
| 5        | Interest                         | 2.58             |
| 6        | Total Capital Cost               | 31.68            |
| 7        | Salvage Value                    | (-)3.40          |
| 8        | Capital Cost Less Salvage Value  | 28.28            |
| 9        | Annual Energy                    | .0               |
| 10       | Annual Labor & Materials         | .01              |
| 11       | Total Annual O&M                 | .01              |
| 12       | Present Worth of O&M             | 0.217            |
| 13       | Total Present Worth              | 28.4             |
| 14       | Equivalent Annual Cost           | 3.08             |

The current compliance schedule is shown in Table 2-2.

**TABLE 2-2  
PROJECT SCHEDULE**

|   | <u>Lake Merced</u> | <u>Richmond</u> |
|---|--------------------|-----------------|
| o Final Project Report and<br>Environmental Review<br>Certification | November 1988      | July 1990       |
| o Complete Step 2 Plans and specs                                   | October 1990       | April 1991      |
| o Notice to Proceed to Contractor                                   | March 1991         | April 1992      |
| o Complete Construction   | November 1992      | September 1994  |

**FINANCIAL PLAN**

The San Francisco Clean Water Program is responsible for financial planning of all project elements of the City's wastewater program. The financial plan and revenue program is described in the Clean Water Enterprise Five Year Revenue Plan 1988/89 - 1992/93, adopted by the Board of Supervisors in July 1988.

Two major sources of funds will be used to finance the Lake Merced and Richmond Projects: Federal/state loans and local revenue bonds authorized for sewerage purposes.

Loans will be provided for 100% of eligible project costs if funds are available and the City qualifies. The City will be responsible for all ineligible costs and for repaying the loan over a period up to 20 years at an interest rate equal to one half of the State General Obligation Bond rate at the time of the loan. Authorization for state loans will require adoption of a Charter Amendment by a majority vote of the electorate, or pursuant to the Charter (Chapter 3, Section 7.300) a three quarter vote of the Board of Supervisors for those projects necessary to comply with federal & state laws. The Lake Merced project is under a Cease and Desist Order of the State Regional Water Quality Control Board.

Under current law, EPA and SWRCB may provide an allowance in the construction loan for design costs as a percentage of the construction cost. Therefore, the City must fund design costs from its own resources until it receives Federal/State construction loans following completion of design.

Existing revenue bond authorizations (the latest adopted 7/88) are sufficient to provide funds for the City's share of costs, for the Lake Merced Project. Sewer revenue bonds are issued pursuant to Resolution No. 973-77 of the Board of Supervisors. Section 6.15 of Resolution No. 973-77 provides the City shall at all times, while any of the bonds remain outstanding, fix and collect rates, fees, and charges for service of the sewerage system so as to yield net revenues in each fiscal year equal to at least 1.25 times debt service becoming due on the bonds in that year.

Sewer service charge rates and procedures, in compliance with the SWRCB Revenue Program Guidelines, were adopted in June 1977, and approved by the EPA.

The current sewer service rates, and systemwide operations, maintenance, and debt service costs are described in detail in the Clean Water Enterprise Revenue Plan. The Clean Water Enterprise budget provides a debt coverage ratio of 1.32, which exceeds the coverage required under the City's bond ordinance.

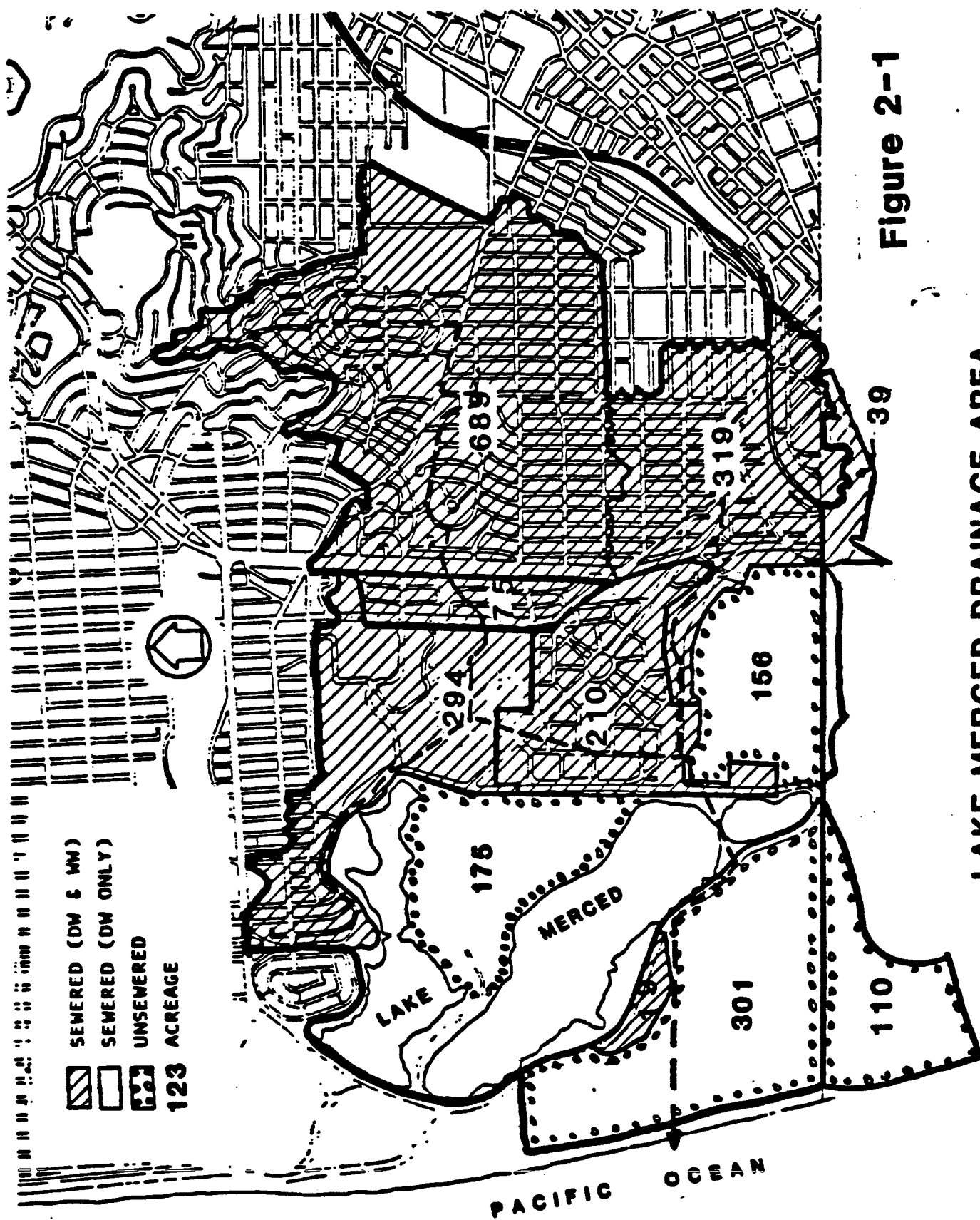


Figure 2-1

LAKE MERCED DRAINAGE AREA

## **CHAPTER 3**

### **EXISTING AND PROJECTED SERVICE AREA CHARACTERISTICS**

Pertinent physical, economic, demographic, and environmental characteristics of the Lake Merced and Richmond Transport Service areas are discussed in this chapter. Descriptions of geographical setting, land use, economic activity, population, air quality, and institutions within the service area are included.

#### **SERVICE AREA BOUNDARIES AND COMPOSITION**

The Lake Merced Transport Service area comprises 2,387 acres of which 1,645 are sewered. (See Figure 3-1). The eastern 40% of the area comprises the higher elevations from west of Mt. Davidson and City College to 19th Avenue. The middle 20% is at somewhat lower elevations. The western 40% of this area is comprised mostly of the two parts of Lake Merced, Harding Park, the northern half of the Olympic Country Club and open area and bluffs on the shore. Except for the bluffs along the shore the western portion elevations are the lowest, falling to sea level at the shoreline. San Mateo County lies at the southern boundary.

The Richmond Transport Sewer Service Study area covers the Central portion of the Richmond District of San Francisco. (See Figure 3-2). The southeastern 40% is relatively flat land. The north-northwestern 30% of the area comprises the higher elevations including Lincoln Park, Fort Miley and Seacliff area. The southwest 30% is relatively a continuous slope toward the Golden Gate Park.

#### **GEOGRAPHICAL SETTING**

The geographical setting includes the topography, geology, and soils, the hydrography of the area and is described in this section.

##### **Topography**

The Lake Merced Transport Service area is located at the southwestern corner of the City of San Francisco. The northeastern boundary is delineated by a ridge starting in the north with Mt. Davidson at Elevation 800 ft. and running south to a peak of around 400 feet. The ridges drop and spread into a wide valley which slopes generally downward towards the west falling to approximately sea level at the two branches of Lake Merced. A tongue of land juts northward from the San Mateo County line separating the lake from the ocean. This tongue of land has a ridge line that drops from about 200 feet above city datum in the south at the county line to only about 20 feet at the northwest corner of the area where the Zoo is located. (See Figure 3-3).



The Richmond Transport Sewer Service area is located at the northwestern corner of the City of San Francisco. The surface elevations throughout the study area are indicated by the contours (City Datum) as shown in Figure 3-4, which show the maximum elevation of about +370 feet in Lincoln Park, and the topographic ridgeline trending northwest-southwest through the campus of George Washington High School (Anza/31st Avenue) and across Lincoln Park. At Fulton St. and the Great Highway, the elevation is about +12 feet.

There are no existing surface streams or lakes in the study area except Mountain Lake and Lobos Creek in the Presidio. All storm runoff is handled by surface infiltration and by the combined sewer system, except along the northern bluffs which drain directly into the Pacific Ocean.

## GEOLOGY AND SOILS

The geology, faults, historical seismicity and geologic hazards in the Lake Merced and Richmond Transport Service areas are discussed in this section.

### Geology

#### Lake Merced Transport Service Area

The hills, or ridges, along the eastern boundary of the Lake Merced Transport Service area are primarily outcrops of bedrock protruding from unconsolidated surface deposits. This bedrock is part of the Franciscan assemblage which extends along the California and Oregon coastal mountain ranges and reaches depths of 10,000 to 50,000 feet. Included here also is locally sheared slope wash derived from the Franciscan bedrock.

The Franciscan assemblage consists of the following principle types of rock in its formation: sandstone, shale, and cert with beds of serpentine, greenstone and sheared rock. Overlying the major area of Franciscan assemblage are extensive deposits of Colma Formation consisting of medium sand with small to moderate amounts of silt and clay. Along the beach front is a line of Merced formation of unconsolidated to firm sand, silt, and clay with minor amounts of gravel, lignite and volcanic ash. Toward the Ocean lays dune and beach sand with well sorted fine to coarse gray sand, generally loose and unconsolidated. In addition there are additional areas which once served as former tributaries of both sections of Lake Merced which are now leveled with artificial fill consisting of clay, silt, sand, rock fragments, organic matter, and man made debris. (See Figure 3-5).

## **Richmond Transport Service Area**

The study area lies in the Coast Ranges Geologic Province of California. Two main bedrock units have been distinguished in this zone: the Franciscan Assemblage and the Great Valley Sequence.

The bedrock geology of the Richmond District has a complex stratigraphy and structure. Outcrops occur primarily along the coast and in Lincoln Park. The bedrock of the rest of the district is covered by soil deposits or has been obscured by urban development. The two bedrock units occur as follows: Great Valley Sequence in the west and the Franciscan Assemblage in the east, which are separated by a wide shear zone (the City College Fault Zone). The eight rock types are: (1) graywacke; (2) sandstone; (3) melange; (4) greenstone; (5) interbedded siltstone and shale; (6) serpentine; (7) chert; (8) limestone.

The Great Valley Sequence in the Richmond District can be divided into two units: (1) a sandstone unit; (2) a sheared, interbedded siltstone and shale. The sandstone unit is dominated by massive, very hard arkosic sandstone. The interbedded siltstone and shale unit is approximately 500 feet wide with beds generally 1 to 6 inches thick and lies immediately adjacent to the City College Fault Zone.

The Franciscan Assemblage is characterized by sections of jointed rock masses separated by shear zones or faults. The jointed rock masses are commonly composed of thick bedded graywacke with minor siltstones and shale, and more rarely chert. Shear zones and faults are generally marked by melanged zones and serpentine lenses. The Franciscan in this locality can be divided into four units. From west to east these units comprise a thrust sheet-melange complex, a bedded graywacke unit, a melange zone, and another graywacke unit.

The thrust sheet-melange complex is characterized by large jointed to brecciated (crushed) tectonic slabs separated by relatively narrow shear zones marked by serpentine. This complex is along the coast from 1000 feet east of Land's End to just west of Land's End.

East of the thrust sheet-melange complex and west of Phelan Beach is a unit of jointed, bedded graywacke with minor interbedded siltstone and shale. This unit forms steel cliffs along the coast with coves and caves formed along the weaker shear zones and interbedded siltstones and shale zones.

The next unit eastward in the Franciscan is a probable melange zone extending south from Phelan Beach. This melange zone is about 500 feet wide.

The eastern most unit, which extends from Phelan Beach to Baker's Beach is characterized by massive graywacke with very minor siltstone and shale. The graywacke of the eastern unit is generally more massive and contains fewer shale and siltstone interbeds than the graywacke of the western unit.

### **Faults**

The Lake Merced Transport Service area is traversed by two inactive faults and shear zones, the San Bruno Fault and the City College Fault.

The Richmond Transport sewer service area is traversed by two inactive faults and shear zones, the City College Fault and the Fort Point-Hunters Point Fault.

These local faults and shear zones are related to deformation within the Franciscan bedrock, but do not offset the overlying unconsolidated deposits.

San Francisco, however, is in a seismically active area and is bounded by two major active faults: the San Andreas fault to the west of the City and the Hayward fault to the east. Other major active faults near San Francisco include Seal Cove fault to the west and the Calaveras fault to the east. In addition the City contains the Fort Point-Hunter's Point shear zone and the San Bruno fault and shear zone which are related to the City's deformation within the Franciscan bedrock.

Detailed discussion of the regional faults is presented on pages 3-4 to 3-6, Chapter 3, Southwest Water Pollution Control Plant Project, Final Project Report, 1980.

### **Geologic Hazards**

There are three major potential geologic hazards in San Francisco: seismic ground shaking, liquefaction, and landslides. Ground shaking is most destructive. Liquefaction is earthquake induced. Landslides can be induced by either earthquakes or gravity.

In the north central section of the Lake Merced Transport Service area there is substantial area susceptible to seismic flooding. The Lake Merced lake areas have several ground failure areas along the shore. Along the ocean beach front there are definite landslide areas.

The potentially geological hazardous areas are presented in Figure 3-6 for the Lake Merced Area and Figure 3-7 for the Richmond Area.

#### **HYDROLOGY: Lake Merced**

The Lake Merced watershed has an area of 2,387 acres, of which 1,645 are presently sewered. It is located in the southwest corner of the city and includes 110 unsewered and 39 sewered acres south of the County line. Drainage follows the natural slope of the watershed in a general westward direction towards the Pacific Ocean.

Rainfall in the Lake Merced watershed averages about 21 inches per year, slightly higher than the city-wide average. The unsewered part of the watershed consists of sandy material and does not contribute significant amounts of overland flow to the city sewer system. Approximately 60 percent of the rainfall falling on the sewered area (1,645 acres) enters the City sewer network in the form of storm runoff and combines with the sanitary flow. The storm runoff amounts to 580 million gallons (MG) per year, on the average, and the sanitary flow generated in the Lake Merced area is about 1,500 MG per year. Of the 2,080 MG of combined flow, currently 340 MG per year overflow into the Pacific Ocean via the Lake Merced outfall. Currently, the average number of overflows per year is 58.

After the construction of the Lake Merced Transport facilities, overflows to the Pacific Ocean will be reduced to 8 or less per year. Similarly, the volume of overflow will be reduced to about 88 MG per year, or less.

During high rainfall intensity storms, the relatively steep slopes in the Lake Merced watershed give rise to occasional large flows which cause the downstream sewers to flow to capacity, with the potential danger of flooding in low lying areas. The proposed Lake Merced transport facilities will help alleviate this potential flooding.

#### **HYDROLOGY: Richmond Transport**

The Richmond watershed has an area of 2,010 acres of which 1,570 are sewered for both dry and wet weather flows and the balance of 440 acres are sewered only for dry weather flows. The northern boundary of the area in question is Lobos Creek and West Pacific Avenue with the exception of the Marin Hospital complex which extends north of this boundary and contributes flow to the Richmond sewer system. The Richmond watershed boundaries and subareas are shown in Figure 3-2.

Rainfall in the Richmond watershed averages about 23 inches per year, slightly higher than the city-wide average. Based on data in the Southwest Water Pollution Control Plant Final Project Report of February 1980, approximately 51 percent of the rainfall falling on the sewered area (2010 acres) enters the sewer network in the form of storm runoff and combines with the dry weather flow. The storm runoff amounts to 0.66 billion gallons per year, on the average and the average dry weather flow is approximately 1.64 billion gallons per year.

Drainage follows the natural slope of the watershed in a general northerly direction. A west-sloping sewer along Lake Street intercepts the flows from 96 percent of the area. During dry weather, all the intercepted flows enter the existing Richmond tunnel at Lake Street and 24th Avenue and gravitate to the Richmond Sunset Water Pollution Control Plant (RSWPCP) for treatment. Dry weather flow from the remaining area which is at lower elevations is pumped to the upstream portal of Richmond tunnel by the Sea Cliff dry weather pump stations. During wet weather, combined flows in the Lake Street interceptor overtop low-crested weirs at 17th Avenue, 22nd Avenue and 24th Avenue respectively and flow into the Pacific Ocean via the outfall structures at Baker Beach and Sea Cliff. Combined flows from the remaining 4 percent of the area (82± acres draining north of Lake Street) in excess of the pumping capacity of the Sea Cliff dry weather pump stations, also overflow into the Pacific Ocean.

Currently, overflows at the above mentioned outfalls occur approximately 40 times per year, on the average. Prior to the activation of the Westside Transport (WST) facilities, part of the combined flow from Richmond that reached the Fulton Street sewer via the existing Richmond tunnel would overflow into the Mile Rock outfall which was abandoned after the 1985 activation of the westside system. Prior to the activation, the average number of overflows attributed to the Richmond area was around 58 per year. Overflow volumes from Richmond before and after the westside activation are estimated at 0.59 and 0.31 billion gallons per year respectively.

After construction of the proposed Richmond Transport facilities, all dry weather flows in the Richmond area would be diverted into the new Richmond tunnel. This would accomplish post-storm flushing of sediment deposits, eliminating the need for a flushing system. The existing Richmond tunnel would be used as a standby. Also, the average number of overflows would be reduced to 8 or less per year, corresponding to an average overflow volume around 0.067 billion gallons per year.

#### ENVIRONMENTAL SETTING

The Lake Merced and Richmond Transport Service areas are primarily residential with large areas of parks and other public lands. The Lake Merced, Ocean Beach along the Great Highway, San Francisco Zoological Gardens, and Stern Grove in the Lake Merced Service area, and the Golden Gate Park, Lincoln Park, the portion of Ocean Beach along the Great Highway, Phelan Beach, Baker Beach, the Presidio, the Palace of Legion of Honor and the Seacliff homes in the Richmond Service area, provide the residents with a variety of parks and recreational activities.

Topography of the Lake Merced Transport Service area is diverse. To the east is Twin Peaks and Mount Sutro, the highest points in the City and district. To the west of Twin Peaks and Mount Sutro, the area has a relatively continuous slope toward the Ocean once out of the steep, hilly zone. The western coast is sandy, with rolling dunes and flat beaches.

Topography of the Richmond Transport Service area is also diverse. At the northwest the highest elevation is at Lincoln Park. From there is a topographic ridgeline toward the Southeast through the George Washington High School campus. To the north-northwest the area slopes steeply toward the beaches. South-southwest from the ridgeline, the area has a relatively continuous slope toward Golden Gate Park and the ocean. To the east, it slopes towards a relatively flat area of land. The western coast is sandy, with rolling dunes and flat beaches.

The ocean beaches in San Francisco have cool, rather harsh weather and therefore plant and animal life along the coast must withstand the windy, foggy, and cloudy climate. Vegetative cover includes ice plant, dune grass, beach grass, sand-verbena, sea rocket, beach pea, beach strawberry, California golden poppy, coyote mint, and seaside paintbrush. Coyote bush and bush lupine are two common shrubs found along the coast. Trees, which grow either singly or in groves, are Monterey cypress, Monterey pine, red-gum eucalyptus, blue-gum eucalyptus, Baily acacia, and black-wood acacia. A number of rare and endangered plant species have been identified in the area, including the western wallflower.

The coastal section of the dry-weather service area supports large numbers of migrating and habitat birds. Gulls, shore-birds such as loons, grebes, and cormorants, geese, wintering ducks, California brown pelican, and songbirds all live and/or feed in this coastal area.

Because of the urban nature of the area adjacent to the beaches, the lack of suitable cover habitat, and a relatively large amount of human activity, there is little wildlife. But animals such as the housemouse, California ground squirrel, gopher, racoon, and striped skink live here. Reptilian inhabitants include the gopher snake, common garter snake, western toad, and lizards. The beach itself supports mole crabs, worms, clams, and shrimp.

The cold waters of the Pacific Ocean are the habitat or migratory route for the California grey whale, striped bass, king and silver salmon, steelhead, and other sport fish. The Dungeness crab, shrimp, anchovy, abalone, and sole are common. There are also sea lion hauling grounds along the coast. This sealife supports both commercial and sport fishing industries in the City.

The San Francisco Zoological Gardens, located northwest of Lake Merced, was opened in 1929. Currently, the Zoo occupies about 63 acres and includes picnic grounds, a children's zoo and a miniature railway in addition to its zoological exhibits. The average yearly attendance is approximately 1 million visitors.

Lake Merced, a natural freshwater recreation lake, is surrounded by a freshwater marshland which supports a great variety of bird life and vegetation. In addition the Lake serves as an emergency water supply, with 2.5 billion gallons available for municipal use.

**POPULATION CHARACTERISTICS, HYDROGRAPHY, LAND USE, ECONOMIC ACTIVITY AND CLIMATE:**

Data provided in the January 1988 Westside Water Pollution Control Facilities Planning Report, Chapter 3, with regard to these topics are not repeated here.

Subsequent to these Reports, the U.S. Congress voted to close the Army installation at the Presidio. Under federal law, this property will become part of the Golden Gate National Recreation Area, National Park Service, under the Dept. of Interior. A planning process has begun for the ultimate uses to be permitted in this area.

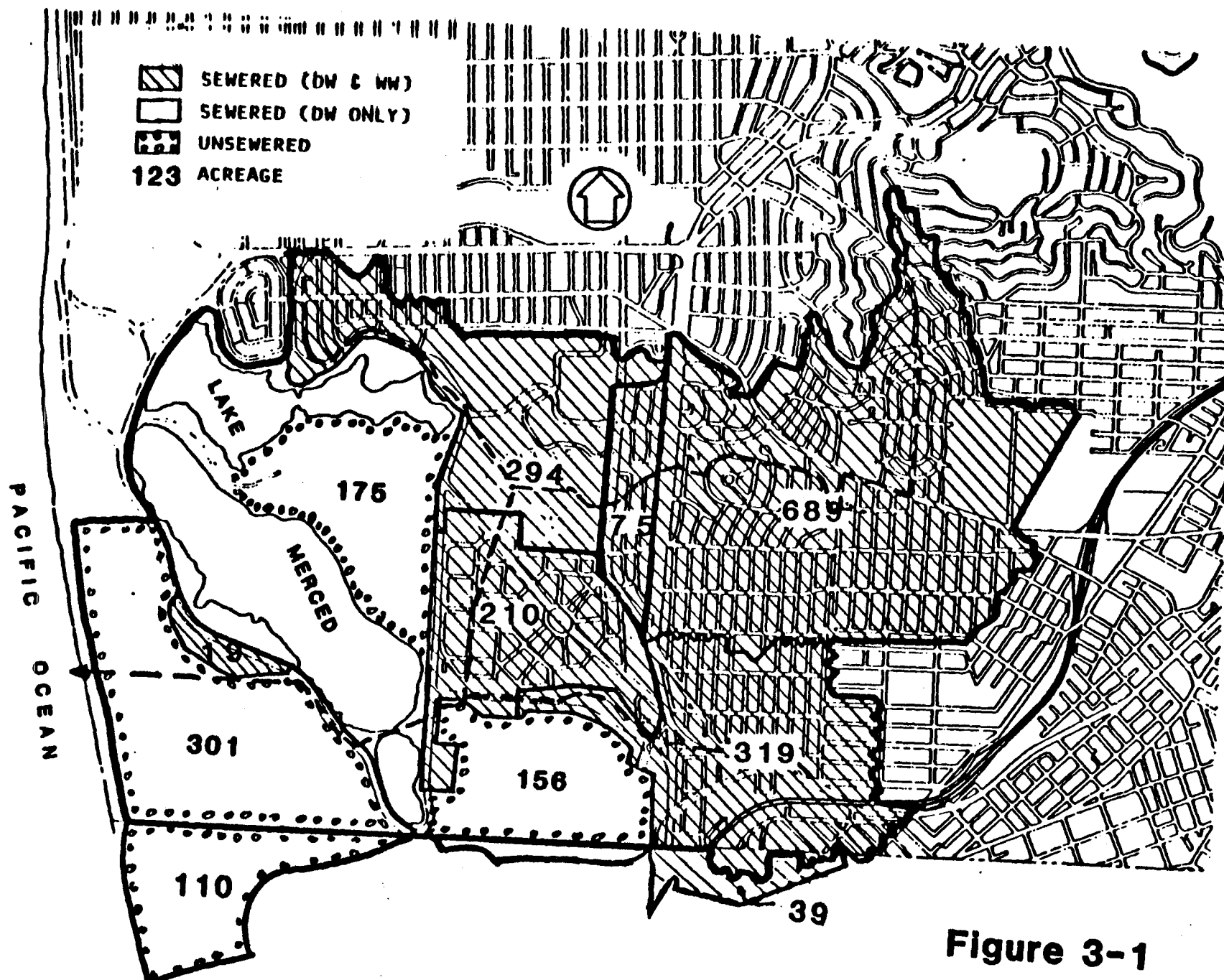
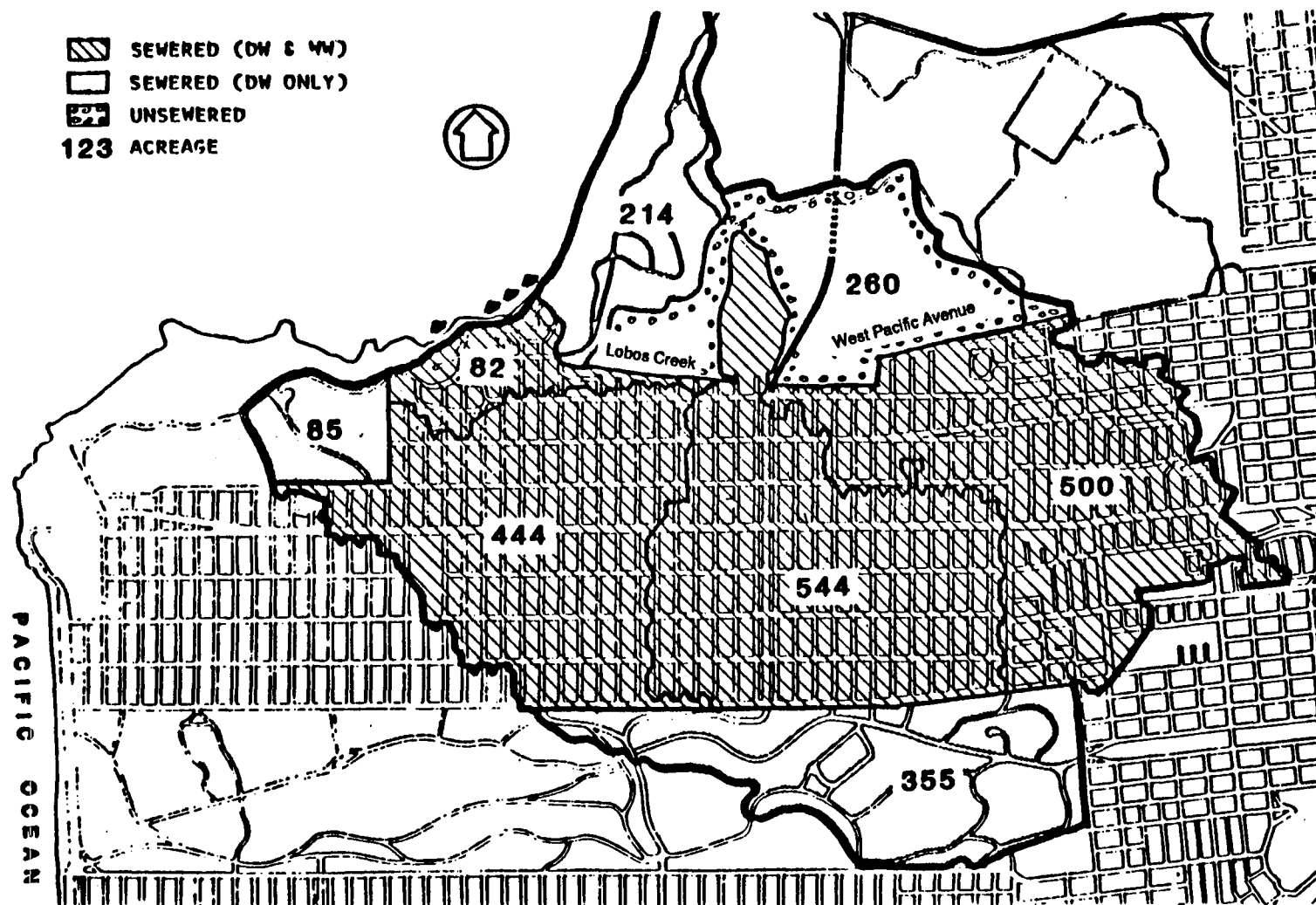


Figure 3-1

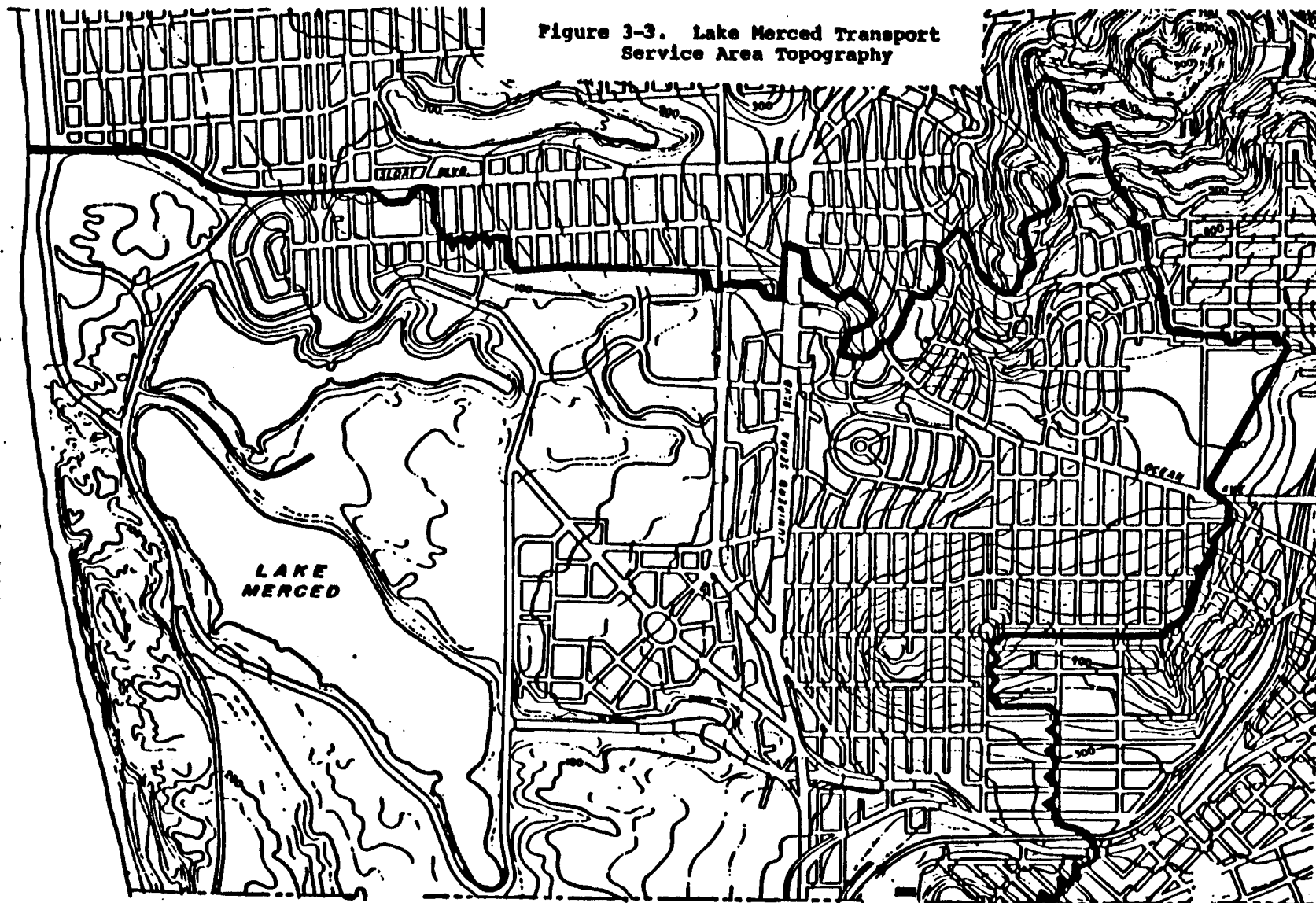
LAKE MERCED DRAINAGE AREA



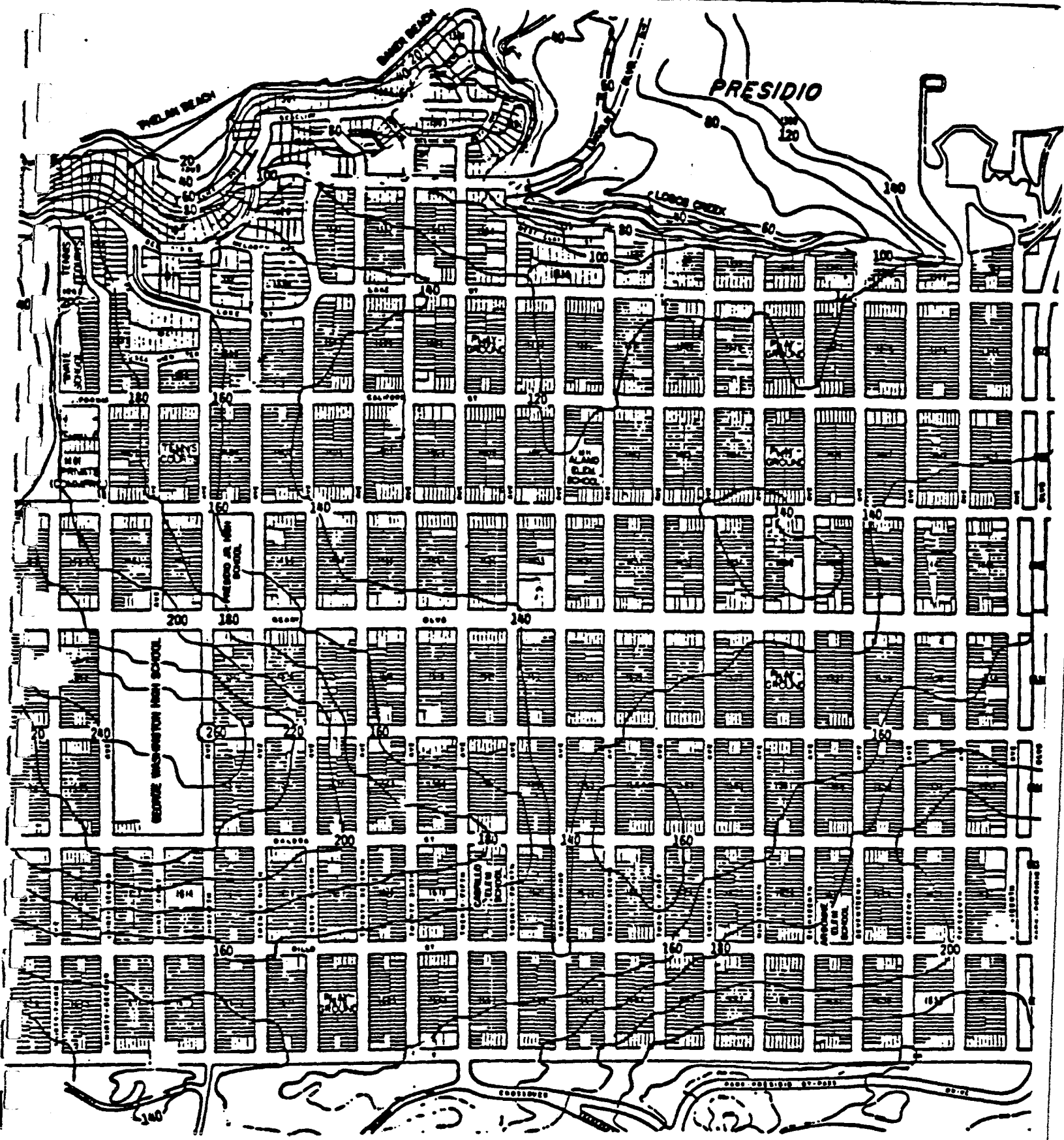


**Figure 3-2 SEACLIFF-RICHMOND DRAINAGE DISTRICT**

Figure 3-3. Lake Merced Transport  
Service Area Topography





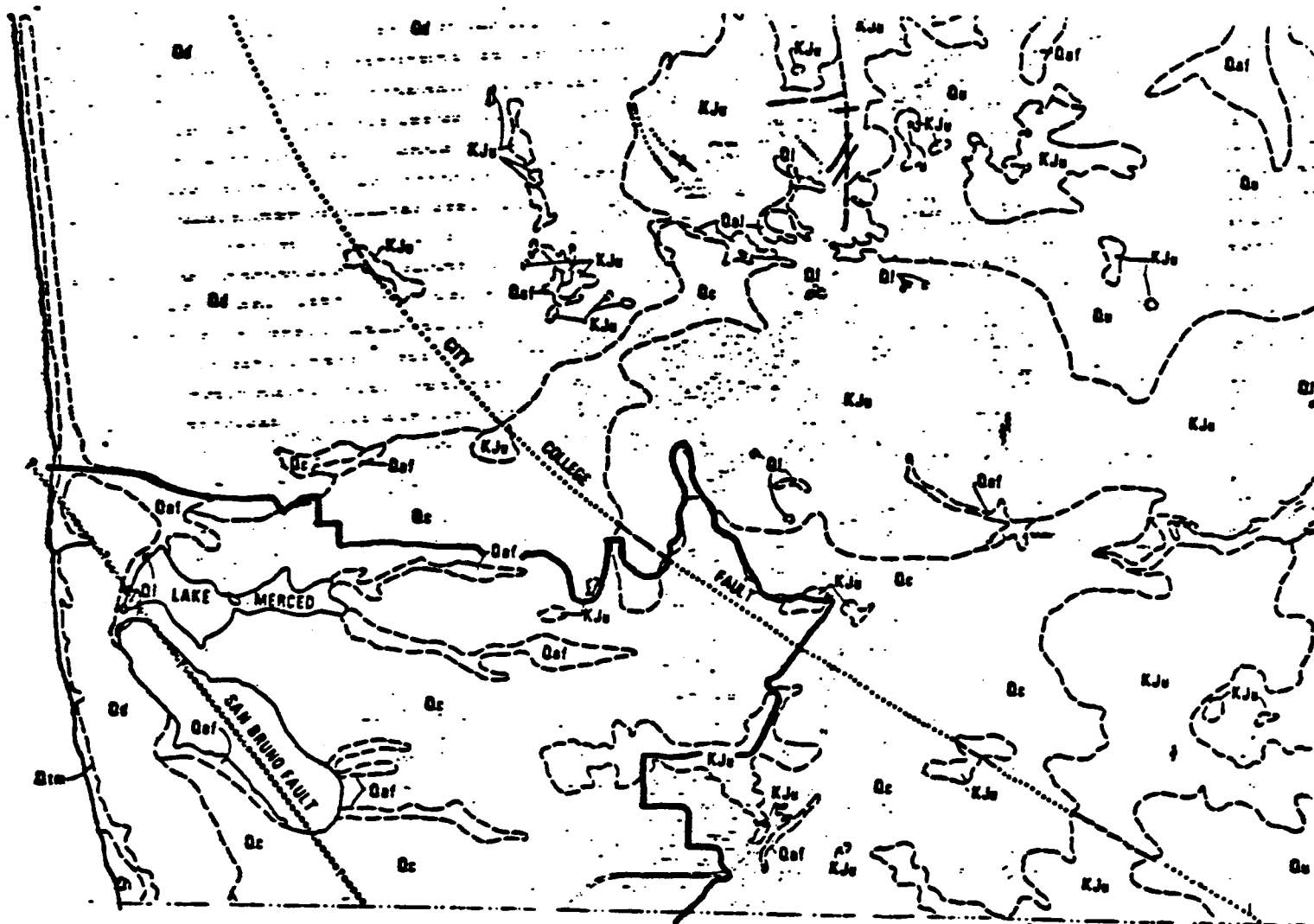


SURFACE ELEVATION  
 IN  
 FEET  
 DATUM - 8.816 FEET

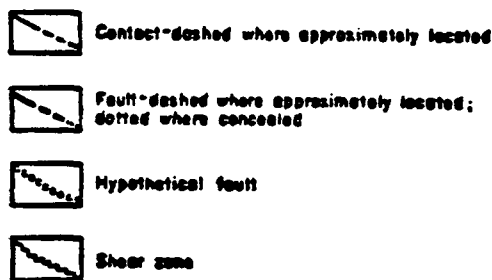
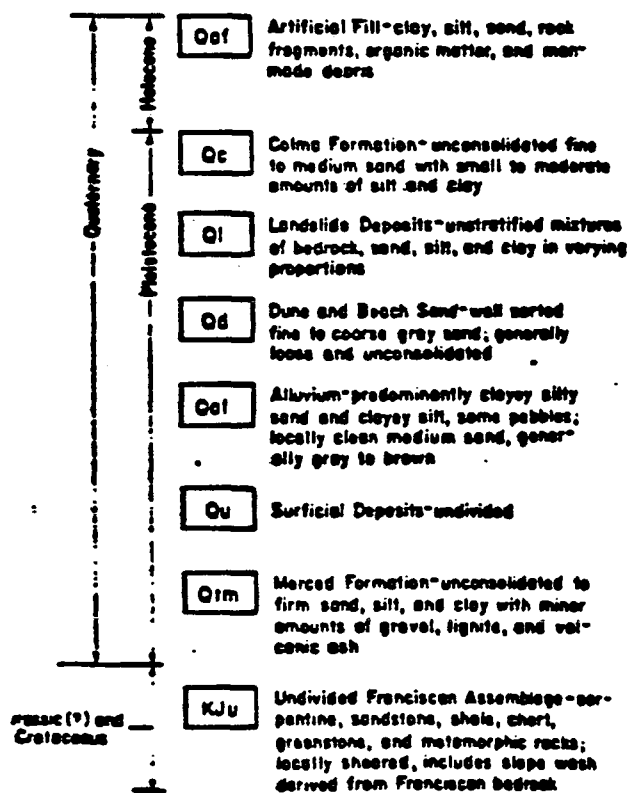
**Figure 3-4**

**Transport Sewer Service Area topography.**



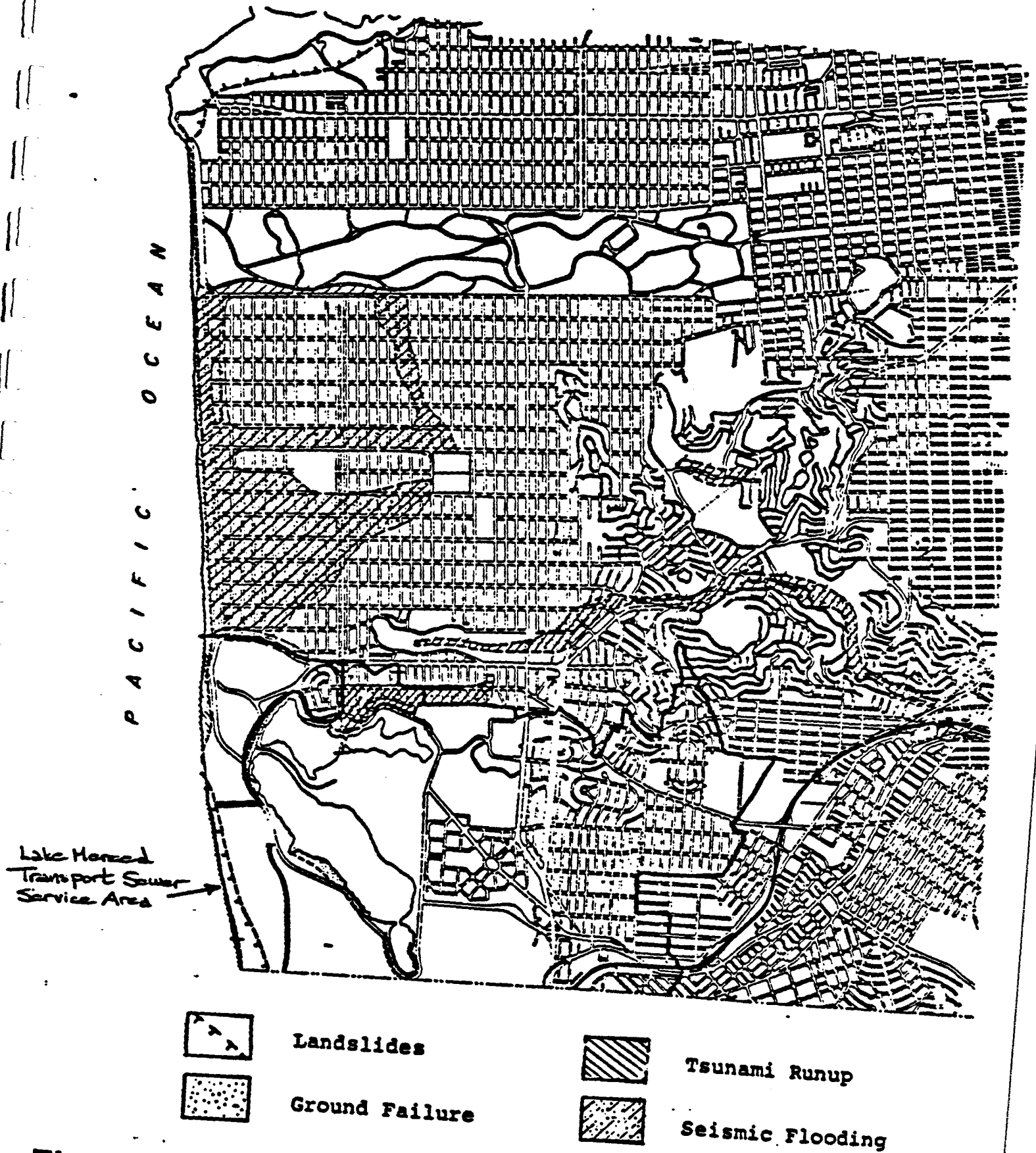


# Geologic Map



Source: Compiled from Schlecker (1974) and Bonilla (1971)

Figure 3-5. Lake Merced Transport Service Area Geologic Map



**Figure 3-6** Lake Merced Transport Service Area Geologic Hazards

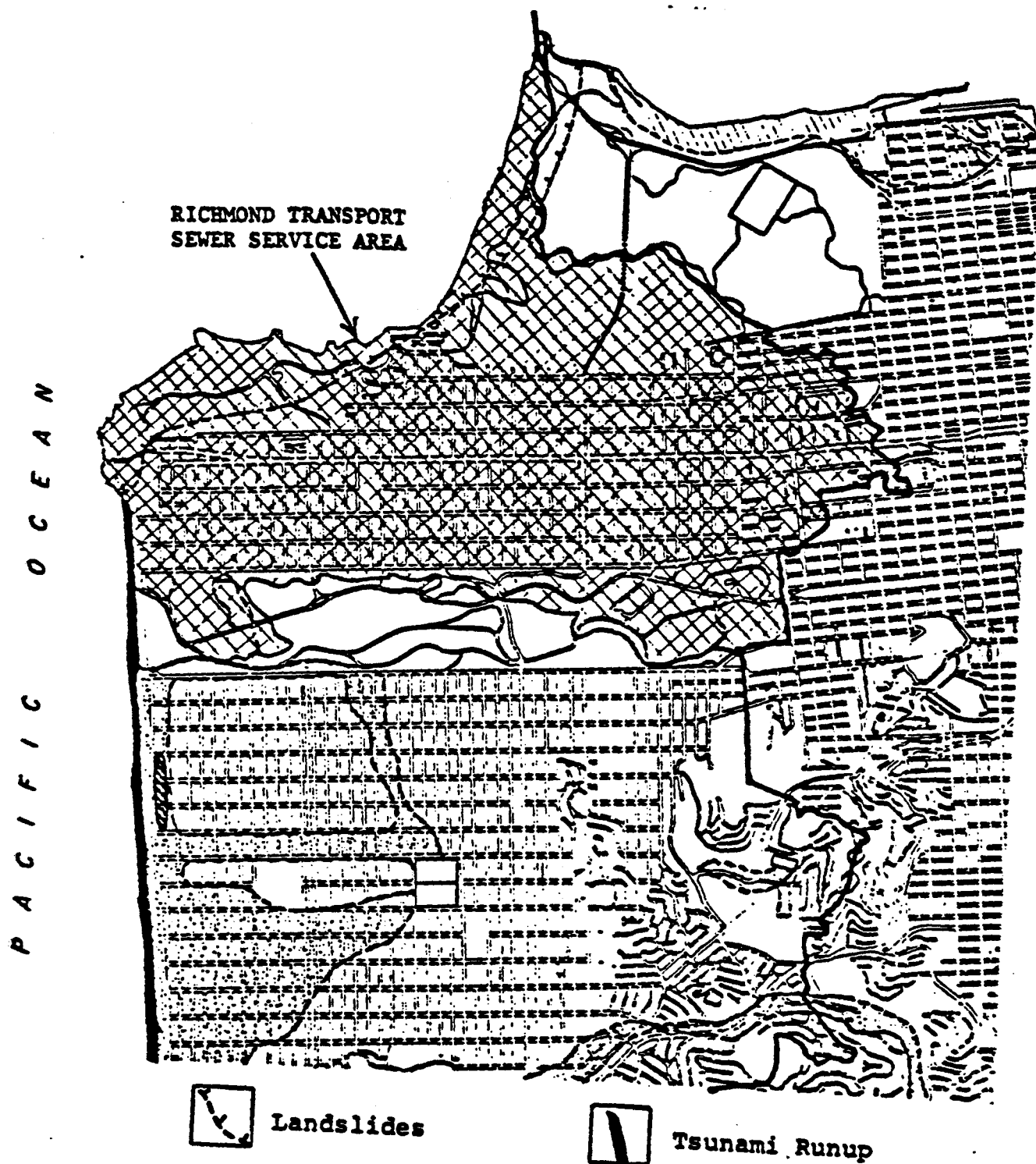


Figure 3-2. Richmond Transport Sewer Service Area Geologic Hazards

## CHAPTER 4

### EXISTING AND PROJECTED WATER AND WASTEWATER CHARACTERISTICS

#### WATER SUPPLY AND USES

##### EXISTING WATER USE

The San Francisco Water Department supplies domestic and industrial water to all of San Francisco and to cities south of San Francisco along the Peninsula, in the Santa Clara Valley and in southern Alameda County.

The City of San Francisco has three major source areas for water supply: (1) Hetch Hetchy reservoir in the Sierras; (2) San Antonio and Calaveras reservoirs and Sunol Filter Galleries in southern Alameda County; and (3) San Andreas, Pilarcitos, and Crystal Springs reservoirs in San Mateo County. A schematic of the water supply system is shown in Figure 4-1.

The quantity of water distributed from each source varies with the season. The Hetch Hetchy Reservoir in Yosemite National Park supplied an annual average of approximately 80% of the San Francisco water supply. San Mateo and Alameda sources each supplied about 10% of the water. The quality of water from these sources varies as shown in Table 4-2.

Well water is used for seasonal irrigation purposes in some parks in the Richmond-Sunset District, San Francisco Zoological Gardens, and along part of the Great Highway. There are four wells in Golden Gate Park and two in the Zoo.

TABLE 4-1. PUMPING CAPACITIES OF WELLS  
IN GOLDEN GATE PARK

|                        | Capacity, gal/d |
|------------------------|-----------------|
| North Mill             | 600,000         |
| South Mill             | 720,000         |
| Arboretum <sup>a</sup> | 400,000         |

a. There are two wells at the Arboretum.



**Table 4-2  
TYPICAL WATER ANALYSES<sup>a</sup>**

|                                    | <b>Hetch Hetchy<br/>Reservoir</b> | <b>Calaveras<br/>Reservoir</b> | <b>San Antonio<br/>Reservoir</b> | <b>San Andreas<br/>Reservoir</b> | <b>Crystal<br/>Springs<br/>Reservoir</b> |
|------------------------------------|-----------------------------------|--------------------------------|----------------------------------|----------------------------------|--|
| <b>Parameter<sup>b</sup></b>       |                                   |                                |                                  |                                  |  |
| Boron                              | 0.04                              | 0.16                           | 0.27                             | 0.06                             | 0.15                                     |
| Calcium                            | 1.6                               | 30                             | 32                               | 16                               | 15                                       |
| Iron                               | 0.08                              | 0.08                           | 0.05                             | 0.06                             | 0.06                                     |
| Magnesium                          | <0.1                              | 10.9                           | 14.6                             | 4.9                              | 2.6                                      |
| Manganese                          | 0.001                             | 0.004                          | 0.008                            | 0.008                            | 0.003                                    |
| Potassium                          | 0.2                               | 1.4                            | 2                                | 0.7                              | 0.6                                      |
| Sodium                             | 1                                 | 13.6                           | 23.2                             | 6.8                              | 5.5                                      |
| Bicarbonate                        | 6.1                               | 137                            | 144                              | 60                               | 51                                       |
| Carbonate                          | 0                                 | 2.2                            | 1.4                              | 0                                | 0.0                                      |
| Chloride                           | 1                                 | 10                             | 24                               | 11                               | 10                                       |
| Fluoride                           | 0.02                              | 0.15                           | 0.18                             | 0.09                             | 0.04                                     |
| Nitrate                            | 1                                 | 1.8                            | 3.3                              | 1.5                              | 1.9                                      |
| Nitrite                            | <0.001                            | <0.001                         | <0.001                           | <0.001                           | <0.001                                   |
| Phosphate<br>(dissolved)           | 0.03                              | 0.05                           | 0.04                             | 0.04                             | 0.04                                     |
| Silica                             | 3.2                               | 6.8                            | 5.2                              | 2.8                              | 3.6                                      |
| Hardness as<br>CaCO <sub>3</sub>   | 3.5                               | 120                            | 140                              | 60                               | 48                                       |
| Alkalinity<br>as CaCO <sub>3</sub> | 5                                 | 116                            | 120                              | 49                               | 42                                       |
| Total Solids,<br>mg/L @<br>180°C   | 14                                | 167                            | 210                              | 83                               | 72                                       |
| Conductivity,<br>umhos/cm          | 11.1                              | 284                            | 351                              | 144                              | 119                                      |
| pH, units                          | 6.8                               | 8.5                            | 8.3                              | 7.9                              | 8  |
| Turbidity,<br>JTU                  | 0.15                              | 0.8                            | 0.9                              | 0.74                             | 0.7                                      |
| Color, units                       | 0                                 | 0                              | 0                                | 0                                | 0  |

Source: Mineral Analysis, San Francisco Water Department - Water Quality Division. Fall 1985.

a. Sampling conducted in October 1985

b. All units in mg/L unless otherwise noted.

The City Water Department operates 2 water filtration plants and 18 chlorination facilities. In addition, lime, alum, and flouride are added at various points in the system.

The Sunol Valley Water Filtration Plant treats all water from the Calaveras and San Antonio reservoirs and the Sunol Filter Galleries and discharges it to the Hetch Hetchy Aqueduct. The San Andreas Filtration Plant treats all water from the San Andreas Reservoir.

Water for the City of San Francisco is drawn from the San Andreas Reservoir and the Hetch Hetchy Aqueduct. In fiscal year 1983, the City's average daily water demand was 155 Mgal/d; the Richmond-Sunset District used approximately one-third or 52 Mgal/d.

#### PROJECTED WATER USE

Historical and projected per capita water use in San Francisco is shown in Figure 4-2. The water consumption rate in the Lake Merced and Richmond Transport service areas is assumed to be the same as the Citywide rate.

The sharp decrease in water use in 1977-1978 is due to water rationing instituted during the 1976-1977 drought and continued water conservation practices. Historical and projected daily water use for Richmond-Sunset District and Lake Merced and Richmond Transport service areas is shown in Tables 4-3 and 4-4.

#### EXISTING WASTEWATER CHARACTERISTICS

The wastewater from the Lake Merced and Richmond Transport service areas is now handled by the Richmond-Sunset WPCP.

The wastewater of the Richmond-Sunset service area is primarily domestic sewage. The industrial wastewater contribution is relatively insignificant. There are only eight sources with flows greater than 0.05 mgd. Of these eight sources, five are hospitals. The industrial flows are summarized in Table 4-5.

**Table 4-5  
Industrial Flows**

| <u>Discharger</u>        | <u>Average Daily<br/>Sewage Flow<br/>(1,000 Gal)</u> | <u>Average Concentration<br/>(mg/l)</u> |            |                             |
|--------------------------|--|---|------------|-----------------------------|
|                          |  | <u>COD</u>                              | <u>TSS</u> | <u>Grease &amp;<br/>Oil</u> |
| U.C. Med Center          | 588  | 716                                     | 93         | 22                          |
| Childrens Hospital       | 87   | 640                                     | 239        | 63                          |
| U.S. Vet. Adm. Hospital  | 145  | 445                                     | 59         | 26                          |
| French Hospital          | 36   | 1602                                    | 90         | 291                         |
| Laguna Honda Hospital    | 195  | 988                                     | 372        | 88                          |
| State University at S.F. | 183  | 684                                     | 279        | 85                          |
| University of S.F.       | 178  | 696                                     | 294        | 94                          |
| S.F. Zoological Gardens  | 449  | 684                                     | 279        | 85                          |

The above total average daily industrial flow is about 1.5 mgd.

Source: Bureau of Water Pollution Control - Industrial Waste Division, 1986

The Richmond-Sunset Plant Flow

The average daily dry weather flow varies from 20 mgd to 22 mgd. The maximum hourly and minimum hourly flow are approximately 43 mgd and 8 mgd, respectively. Diurnal fluctuations of the dry-weather flow from low to high of 1 to 5 mgd are common. Low flow periods occur during the night and peak flow periods occur during the morning and evening.

Wet weather flow has reached 50 mgd on a few occasions. However, the maximum wet weather flow, which can reliably be treated at this plant, is 43 mgd. This flow rate is often restricted when a major pretreatment or primary treatment unit is out of service.

It is expected that the dry-weather flowrates and wet-weather flowrates will remain essentially the same in the future, although the volume of flow to be treated will increase as a result of the Westside Transport. The WST captures part of the wet weather flow prior to decanting to the SWOO in order to achieve a reduction of untreated overflows to Ocean Beach. This captured wet weather flow is pumped back to the plant as treatment capacity is available after storms.

### The Sewage Characteristics

The RSWPCP exhibits typical primary treatment performance efficiencies. The 1982-1987 plant influent and effluent monthly average total suspended solids (TSS), biological oxygen demand (BOD) and grease and oil (G/O) are as follows:

|           | <u>Plant Influent</u> | <u>Plant Effluent</u> |
|-----------|-----------------------|-----------------------|
| TSS, mg/l | 110-310               | 55-110                |
| BOD, mg/l | 75-300                | 90-185                |
| G/O, mg/l | 30- 60                | 24- 42                |

Figures 4-3, 4-4 and 4-5 show the plant influent and effluent TSS, BOD, and G/O between 1982 and 1987.

Analysis of TSS and BOD are required for facility planning. In addition, G/O was also selected for evaluation because facilities must meet Federal and State discharge requirements. The following summary of the results of the analysis includes reference to the interim discharge limits presently in effect, the 1983 State Ocean Plan and EPA secondary treatment discharge requirements contained in NPDES Permit No. CA00-37681. These discharge requirements will be discussed in Chapter 6 - Discharge Requirements and Degree of Treatment.

#### Total Suspended Solids (TSS)

During the dry-weather months (May-October), the plant influent monthly average TSS is 190 mg/l and monthly maximum is 280 mg/l. The plant effluent monthly average TSS is 74 mg/l. The present plant dry-weather effluent TSS can only meet the State Ocean Plan discharge requirement (60 mg/l 30 day monthly average, or 75% removal if the influent TSS is above 240 mg/l) about 15 percent of the time. The present plant dry-weather effluent TSS cannot meet the secondary treatment discharge requirements.

During the wet weather months (November-April), the plant influent monthly average TSS is 170 mg/l. The plant influent monthly maximum TSS is 250 mg/l. The present plant wet weather effluent TSS can meet the State Ocean Plan discharge requirements of 60 mg/l about 15 percent of the time.

During sustained and intermittent rainfalls (lasting more than three days), the plant influent average TSS is 125 mg/l. The plant effluent average TSS is 57 mg/l.

#### Biochemical Oxygen Demand (BOD)

During the dry-weather months, the plant influent monthly average BOD is 200 mg/l. The plant influent monthly maximum BOD is approximately 270 mg/l. The plant effluent monthly average BOD is 152 mg/l. BOD is not included either in the interim discharge limits or in the State Ocean Plan discharge requirements. The present plant effluent BOD cannot meet secondary treatment discharge requirements of 30 mg/l.

During the wet weather months, the plant influent monthly average BOD is 180 mg/l. The plant influent monthly maximum BOD is approximately 240 mg/l. The plant effluent monthly average is 148 mg/l.

During sustained and intermittent rainfalls, the plant influent average BOD is 130 mg/l. The plant effluent average BOD is 110 mg/l.

#### Grease and Oil (G/O)

During the dry weather months, the plant influent monthly average G/O is 44 mg/l. The plant influent monthly maximum G/O is estimated to be approximately 54 mg/l. The plant effluent monthly average G/O is 32 mg/l. At present, G/O is not included in the interim discharge limits. The present plant effluent G/O can meet the State Ocean discharge requirements 30 day average discharge requirements of 25 mg/l about 20 percent of the time.

During the wet weather months, the plant influent monthly average G/O is 40 mg/l. The plant influent monthly maximum G/O is 49 mg/l. The plant effluent monthly average G/O is 31 mg/l. The present plant effluent G/O can meet the State Ocean discharge requirement of 25 mg/l about 30 percent of the time.

During sustained and intermittent rainfalls, the plant influent average G/O is 32 mg/l. The plant effluent average G/O is 24 mg/l.

## INFILTRATION/INFLOW ANALYSIS (I/I)

In 1974, the City prepared the Sewer System Evaluation for Infiltration/Inflow for the Richmond-Sunset District. This section is a summary of the major points in that evaluation that are pertinent to the Lake Merced and Richmond Transport Sewer Service Areas.

### Purpose and Definition.

The purpose of this analysis was to determine (1) if excessive I/I existed in the sewer system, and (2) if repair of the defects in the sewer system was cost effective compared to transport and treatment of I/I flow volumes. In accordance with EPA "Guidelines for Sewer System Evaluation" and the SWRCB "Project Report Guidelines", this analysis studied the following items:

- o A general discussion of age, length, type, construction material, and physical condition of the sewer system.
- o Existing population data and industrial flows in the sewer system.
- o Flow data for all flows in the sewer system including overflows.
- o Location, frequency, and cause of overflow conditions in the collection/treatment system caused by I/I.
- o Geographical and geological conditions which may affect the present and future quantities or correction costs of the I/I.

The following definitions are used in the I/I analysis:

- o Infiltration. The water entering a sewer system and service connections through such means as, but not limited to, defective pipes, pipe joints, connections, or manhole walls. Infiltration does not include, and is distinguished from, inflow.
- o Inflow. The water discharged into a sewer system and service connections from, but not limited to, such sources as roof leaders; cellar, yard, and area drains; foundation drains; cooling-water discharges; drains from springs and swampy areas; manhole covers; cross-connections from storm sewers and combined sewers; catchbasins; stormwater; surface runoff; street water; or drainage. It does not include, and is distinguished from, infiltration.

- o Infiltration/Inflow. The total quantity of water from both infiltration and inflow.
- o Excessive Infiltration/Inflow. The quantities of I/I that can be economically eliminated from a sewer system by repairing defects, as determined by a cost-effective analysis.

#### Existing Conditions

The Richmond-Sunset district has approximately 340 miles of combined sewer, 58 miles of which are in the Lake Merced Transport Sewer Service Area and 115 miles of which are in the Richmond Transport Sewer Area. Most of the sewers are clay pipes with mortar joints, 40 to 70 years old. None of the sewers are constructed on piles. The larger transport sewers are reinforced concrete.

The project sewered area is predominantly residential with very little industry. Wastewater flows are basically domestic in origin. Under the Standard Industrial Classification, the industrial flows are defined as "services", specifically Zoo, school, and hospitals. (See Table 4-5).

Infiltration/inflow in the Lake Merced and Richmond Transport project areas is not affected by geography and geology. Most of the outfalls are located above the influence of tidal or wave action, and those outfalls on the beach have tide gates to prevent salt water inflow. The sewer pipelines are also not affected by tidal fluctuations or salt water infiltration from the Ocean because of their elevation. Groundwater movement into the sewer (infiltration) is small because most of the sewers are located above the water table.

These facts indicate that wet-weather inflow is the major portion of the I/I flow. Wet-weather inflow is primarily dependent on the intensity and duration of rainfall. Approximately 55% of the precipitation falling in the Lake Merced and Richmond Transport tributary areas becomes stormwater runoff in the combined sewer system. The amount of this stormwater runoff averages about 0.58 billion gallons per year in the Lake Merced area and 0.66 billion gallons per year for the Richmond area. Because the City has decided to keep a combined sewer system, this inflow volume will not be eliminated from the system.

The probable total I/I volume can be determined by a simple mass balance. The balance compares the portion of domestic water supplied that enters the sewer with the metered dry-weather flow. As determined during December 1973 and January 1974 by the Department of Public Works, probable I/I was 0.23 Mgal/d in the Lake Merced Transport area or approximately 1.14% of the dry-weather flow for the Richmond-Sunset WPCP and 0.46 Mgal/d in the Richmond Transport area or approximately 2.26% of the dry-weather flow for the Richmond-Sunset WPCP during this two-month period. In the North Point I/I study, it was reported that approximately 35% of the I/I volume was infiltration. If this same relationship is assumed for the Lake Merced and Richmond Transport areas, the 0.23 Mgal/d of I/I would result in 0.15 Mgal/d of inflow and 0.08 Mgal/d of infiltration, and the 0.46 Mgal/d would result in 0.30 Mgal/d of inflow and 0.16 Mgal/d of infiltration. This relatively small volume of infiltration is distributed throughout 58 miles of sewers in the Lake Merced Transport area and 115 miles in the Richmond Transport area.

As a side benefit of two major ongoing City sewer repair programs within the Department of Public Works, the volumes of infiltration into the system and ex-filtration of sewage from the system will decrease. The San Francisco Flooding Control and Sewer Replacement Program is enlarging existing hydraulically inadequate sewers and replacing or reconstructing structurally unsound sewers. Under this program, a television sewer inspection unit is locating defective pipes and existing and potential leaky joints in the sewer pipelines. The routine maintenance program is involved in the day-to-day maintenance and repair of the sewer pipelines. Accordingly, these two programs result in infiltration problems being reduced as they are encountered.

#### COST ANALYSIS\*

The cost analysis of the I/I problem focuses on two alternatives:

- o Repair of infiltrating sewers
- o Transport and treatment of I/I volumes

\*1974 costs.



In 1974, it was reported that 30% of 17.4 miles of the Lake Merced Transport sewers and 34.5 miles of the Richmond Transport sewers require examination to isolate the major sources of infiltration (0.08 Mgal/d for Lake Merced and 0.10 Mgal/d for Richmond). The annual cost of examining these sewers to locate infiltration would be \$52,600. The cost estimate for the transport and treatment of both dry and wet weather I/I is \$54,000 per year. Since the annual cost for only locating the infiltration sources is nearly as much as the annual cost for transporting and treating the infiltration, it is impractical to consider the former alternative, especially as costs for eliminating of the infiltration have not been estimated.

Based on this analysis, from an economic standpoint, there is not excessive I/I in the Lake Merced and Richmond Transport project areas. It would be difficult and uneconomical to locate and identify the sources of the 0.23 Mgal/d I/I in the Lake Merced area and the 0.46 Mgal/d I/I in the Richmond area considering the large contributing area and length of sewers involved. Furthermore, almost 80% of the flow is planned wet-weather inflow into the system, such as hill drainage and street runoff, rather than defects in the sewers. It is more practical and economical to transport and treat the I/I volumes.

#### UNIT DESIGN LOADINGS AND PROJECTED WASTE LOADS

##### Projected Dry Weather Flow Loads

The dry weather flow design loadings for the service area are based on the population data and the wastewater analysis. The design loadings are summarized below:

##### **Fow**

|                           |     |
|---------------------------|-----|
| Gallons per Capita        | 105 |
| Average monthly flow, mgd | 21  |
| Maximum hourly flow, mgd  | 43  |
| Minimum hourly flow, mgd  | 8   |

##### **TSS**

|                       |     |
|-----------------------|-----|
| Average monthly, mg/l | 190 |
| Maximum monthly, mg/l | 280 |

**BOD**

|                       |     |
|-----------------------|-----|
| Average monthly, mg/l | 200 |
| Maximum monthly, mg/l | 270 |

**Grease & Oil**

|                       |    |
|-----------------------|----|
| Average monthly, mg/l | 44 |
| Maximum monthly, mg/l | 54 |

Source: RSWPCP operational data, 1982-87

It is estimated that the Lake Merced drainage area contributes about 4 mgd, and Richmond about 5 mgd of the 21 mgd average monthly flow. Loadings are not expected to increase overtime.

**Projected Wet Weather Flow Loads**

The wet weather flow design loadings for the treatment plant in the service area are based on the analysis of the wastewater during sustained and intermittent rainfall events. The design loadings are summarized below:

**Flow**

|                             |    |
|-----------------------------|----|
| Maximum sustained flow, mgd | 43 |
|-----------------------------|----|

**TSS**

|               |     |
|---------------|-----|
| Average, mg/l | 170 |
| Maximum, mg/l | 250 |

**BOD**

|               |     |
|---------------|-----|
| Average, mg/l | 180 |
| Maximum, mg/l | 240 |

**Grease & Oil**

|               |    |
|---------------|----|
| Average, mg/l | 40 |
| Maximum, mg/l | 49 |

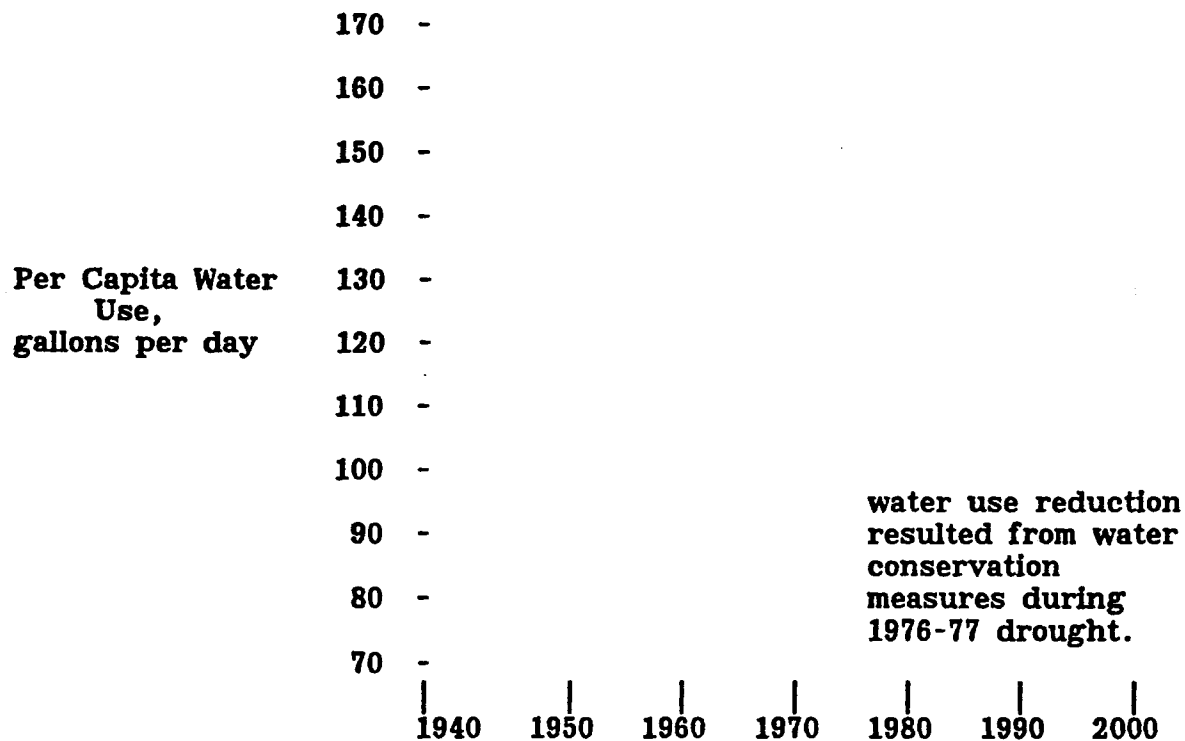
Source: RSWPCP operational datam 1982-87

Because San Francisco's combined sewer system carries both municipal wastewater and intercepted surface runoff in the same sewer, stormwater runoff from intense rainfall in San Francisco can exceed the municipal wastewater volume from the same area by 50 to 100% or more.

Overflows into the Ocean frequently occur in the Richmond-Sunset District because the Richmond-Sunset WPCP has a limiting peak hydraulic capacity of 45 Mgal/d. Approximately 0.34 billion gallons is bypassed through the outfall in the Lake Merced Transport project area, and approximately 0.66 billion gallons is bypassed through the three outfalls in the Richmond Transport project area.

Treatment of the wet-weather flow is necessary to prevent, or greatly reduce, the discharge of combined untreated domestic wastewater and storm runoff. Wet-weather flow from the Lake Merced and Richmond Transport project areas is to be transported to and treated at the Richmond-Sunset WPCP until completion of the new Oceanside Water Pollution Control Plant scheduled for 1993. Flows which exceed the capacity of these facilities will be decanted in the WST before discharge through SWOO.

**Figure 4-2**  
**HISTORIC AND PROJECTED PER CAPITA WATER USE**  
**FOR SAN FRANCISCO**



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**Source: Public Utilities Commission, City & County of San Francisco**

## REFERENCES

- 4-1 J. B. Gilbert & Associates. Overview Facilities Plan: San Francisco Master Plan Wastewater Management. August 1975.
- 4-2 Metcalf & Eddy, Inc. Southwest Water Pollution Control Project, Final Project Report. February 1980.
- 4-3 City and County of San Francisco Department of Public Works, Bureau of Sanitary Engineering. Industrial Waste Program Comprehensive Report. June 1978.
- 4-4 City and County of San Francisco Department of Public Works. Sewer System Evaluation for Infiltration/Inflow, Phase I, Richmond-Sunset District. December 1974.
- 4-5 City and County of San Francisco Department of Public Works. Sewer System Evaluation for Infiltration/Inflow, Phase I, North Point District. February 1974.
- 4-6 City and County of San Francisco Department of Public Works. Appendix to - The Comprehensive Master Plan Preliminary Report; Volume 2. June 1973.
- 4-7 City and County of San Francisco Clean Water Enterprise. Westside Treatment Phase II, Preliminary Draft Project Report. April 1987.

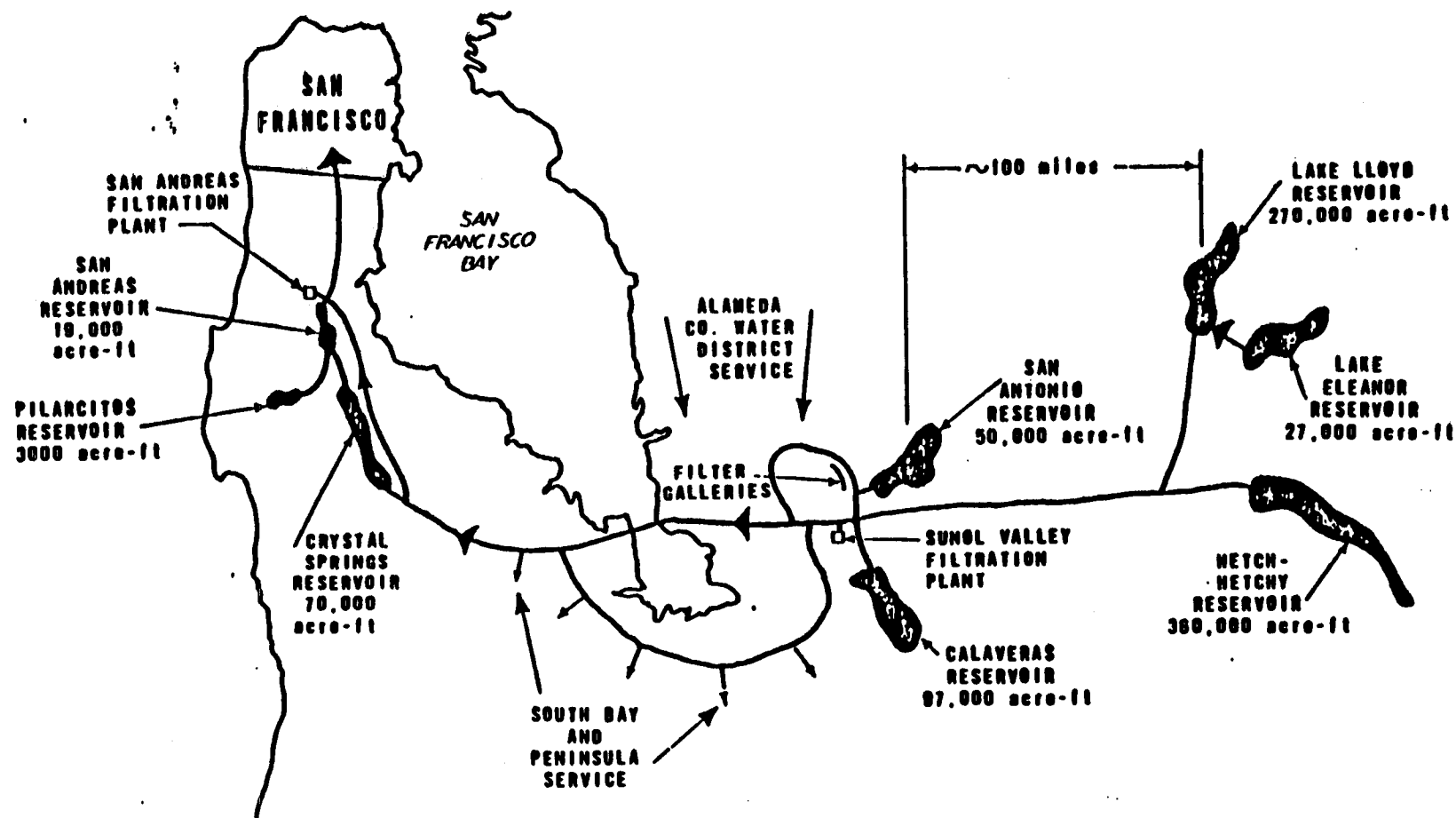
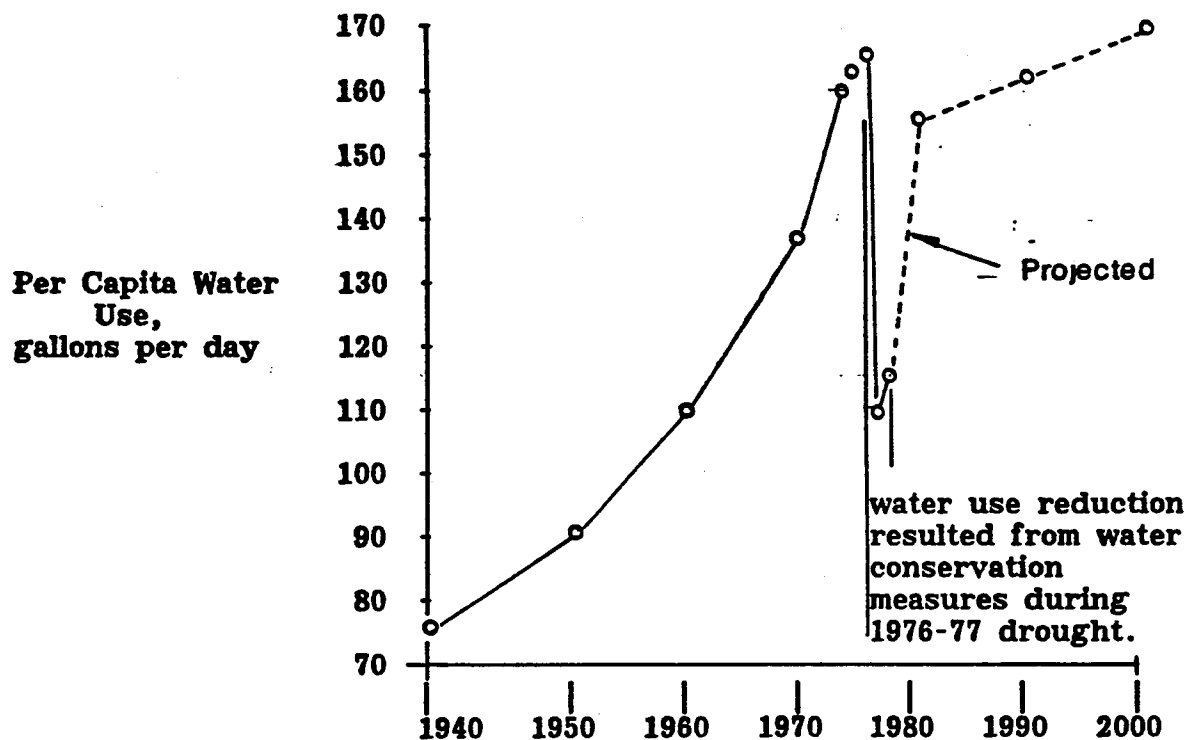


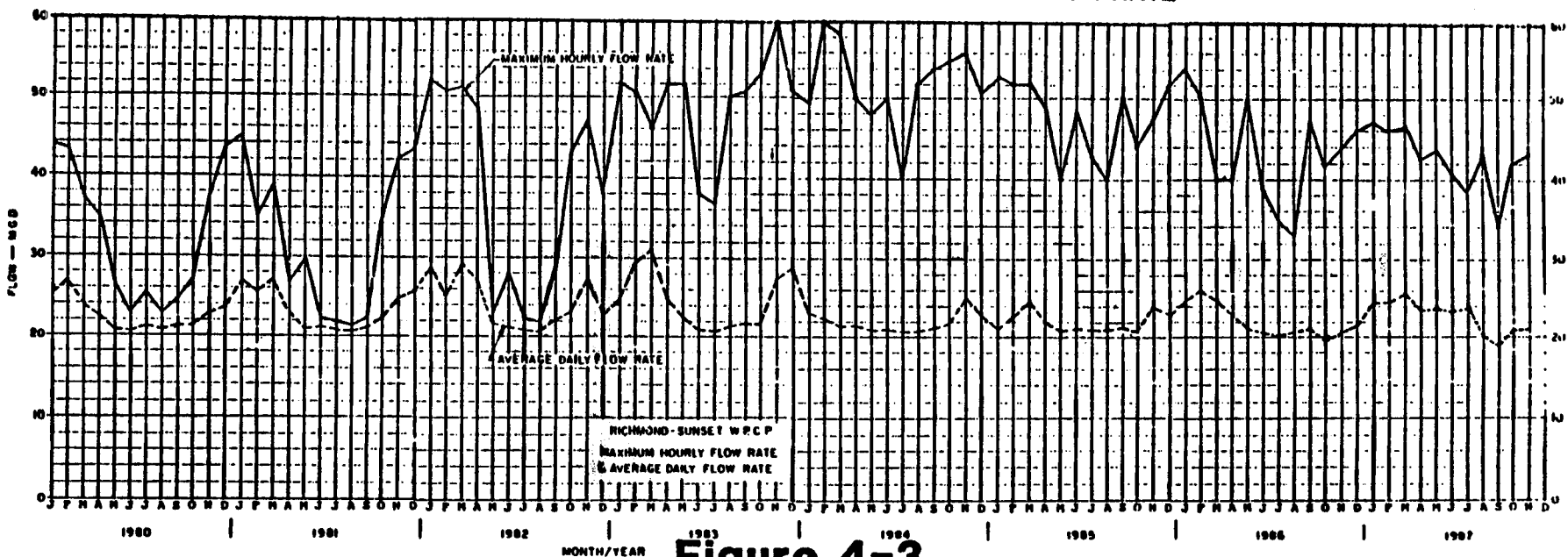
FIGURE 4-1. SAN FRANCISCO WATER DEPARTMENT SYSTEM [4-1]

**Figure 4-2**  
**HISTORIC AND PROJECTED PER CAPITA WATER USE**  
**FOR SAN FRANCISCO**



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Source: Public Utilities Commission, City & County of San Francisco

**Figure RICHMOND-SUNSET WPCP  
MAXIMUM HOURLY FLOW RATE AND AVERAGE DAILY FLOW RATE**



**RICHMOND-SUNSET WPCP TOTAL SUSPENDED SOLIDS - MONTHLY AVERAGES**

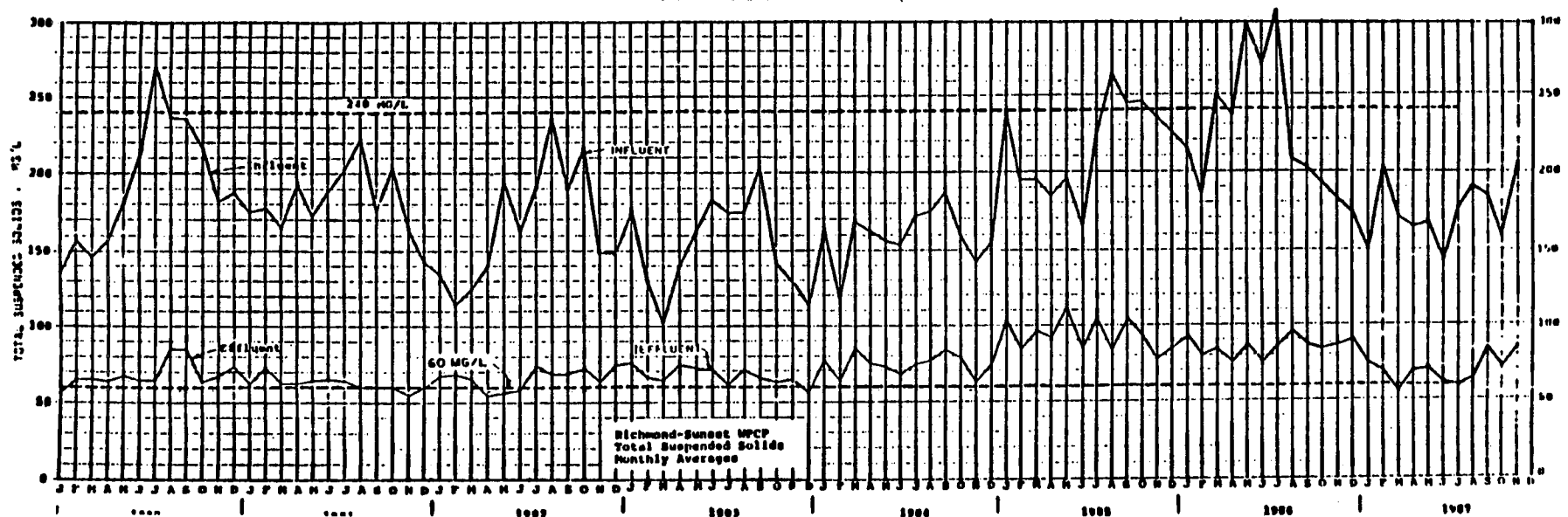




Figure 4-4

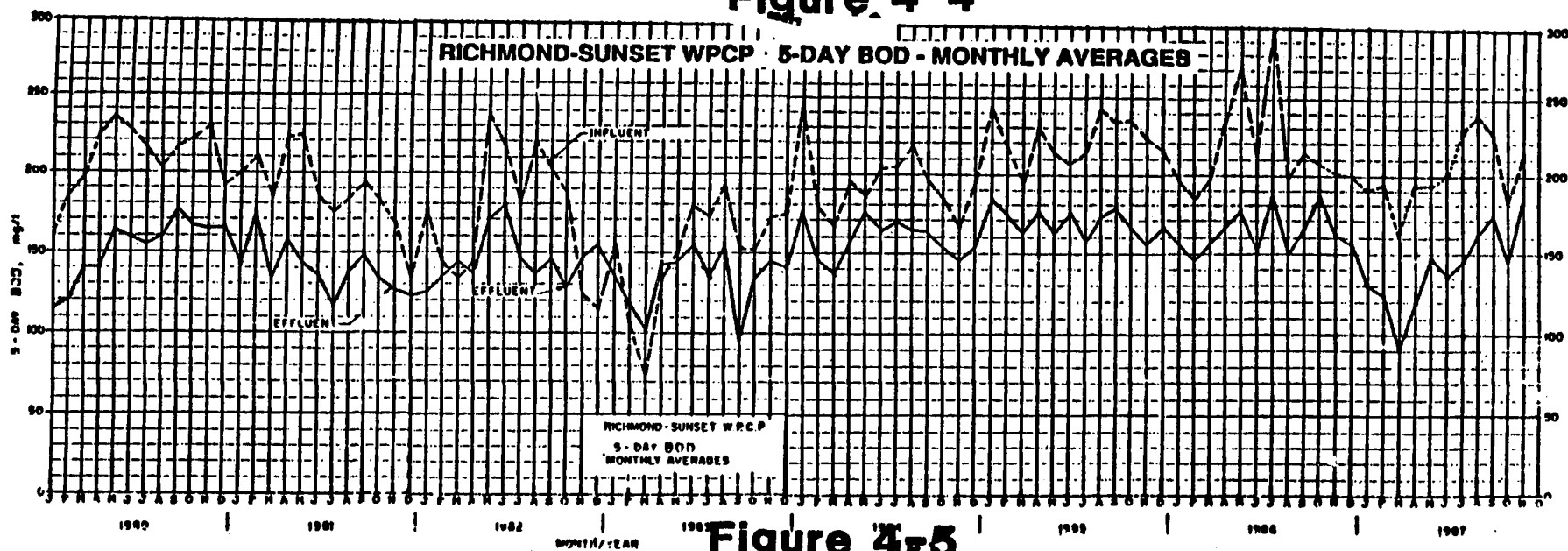
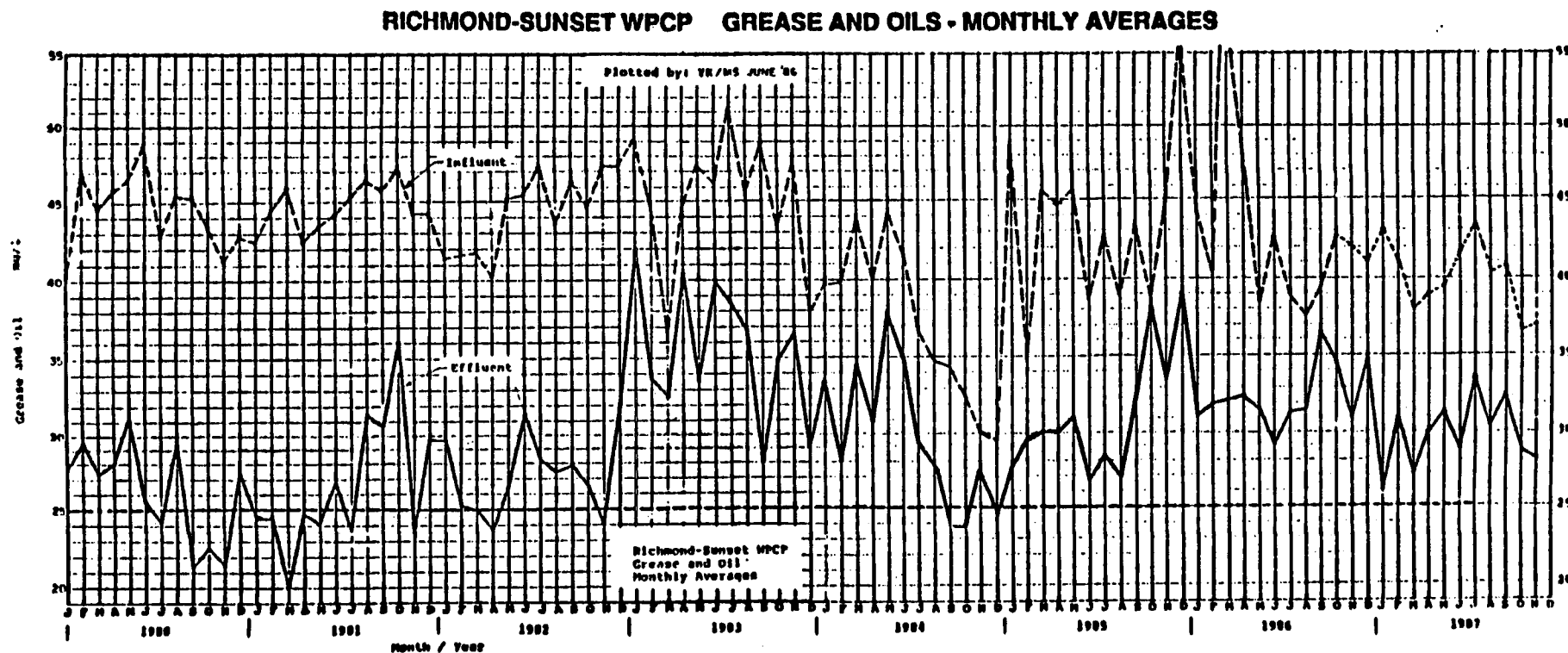


Figure 4-5



## **CHAPTER 5**

### **ANALYSIS OF EXISTING WASTEWATER FACILITIES**

#### **INTRODUCTION**

The existing dry and wet weather facilities are discussed with respect to the Lake Merced and Richmond Transport projects.

#### **TREATMENT PLANT LOCATION AND COLLECTION SYSTEM CONFIGURATION**

The Richmond-Sunset WPCP is the only major treatment facility that serves the entire west side of the City. The Lake Merced and Richmond Transport service areas are part of the area that the plant serves. This plant is located in the Southeast corner of the Golden Gate Park, which is outside of the Lake Merced Transport service area. (See Figure 1-1, Ref. 5-1). The RSWPCP is discussed in detail in the January 1988 Westside Pollution Control Facilities Planning Report, Chapter 5.

#### **Lake Merced Transport Service Area Dry-Weather (DW) System Configuration (See Figure 5-1).**

The existing sewerage scheme basically takes the sewage from the higher elevations of the eastern third of the project service area and leads it into two westerly flowing collector sewers appropriately sited in the two westward oriented natural drainage troughs in the terrain. These collector sewers, picking up additional sewage as they go, each flow through a diversion structure just east of 19th Avenue; the northerly one near Lyndhurst Drive, the southerly in Brotherhood Way.

Both of these diversion structures permit the dry weather (DW) flows to enter northward leading sewers. These sewers pick up DW flows from the middle third of the Lake Merced drainage area and enter the Vicente Sewer north of the Lake Merced Drainage Area. Here they join other flows and flow north to the Richmond-Sunset Water Pollution Control Plant in Golden Gate Park.

The DW flows from the Stonestown Shopping Center and the northern two thirds of San Francisco State University (SFSU) are led into the northward flowing DW sewers noted above.

DW flows from the southern third of SFSU, from the Park Merced apartment complex and from the church complex in Brotherhood Way flow into the large WW sewers in this area and are led south and west to a point under John Muir Drive near the Lake Merced Pump Station. The DW is pumped in a general northerly direction through its associated 18" diameter force main. This force main lies, successively, under John Muir Drive and Skyline Boulevard and at a high point in Skyline Boulevard at its junction with Lakeshore Drive

near the eastern boundary of the Zoo and discharges into a 48" diameter gravity sewer, joining the DW flows from the small residential area bounded by Lakeshore, Skyline, Sloat and Sunset Boulevards. This flow is northward past the Vicente Street sewer and to the Richmond-Sunset Plant.

The three areas comprising Harding Park between the two arms of Lake Merced, the San Francisco Zoo, and the open area south of the Zoo occupied by the Army Reserve and National Guard installations are separately sewered. These DW flows are led northward from all three areas and join together at two points on the Zoo property. They flow northward eventually entering a 30" sewer in 47th Avenue which leads the flows to the Richmond-Sunset plant.

**Richmond Transport Service Area Dry-Weather (DW) System Configuration (See Figure 5-2).**

The existing sewerage scheme basically takes the sewage from areas east of Arguello Boulevard and leads it westerly into a collector sewer along Arguello Boulevard. This collector sewer picks up additional sewage as it flows in a northerly direction and turns westerly at California Street. At 8th Avenue, it turns north and flows into the Lake Street collector sewer. The Lake Street sewer is the main sewage collector for the area south of Lake Street and also picks up flow from the U.S. Marine Hospital north of Lake Street. The Lake Street sewer, receiving sewage as it goes westerly, passes through structures at 17th, 22nd and 24th Avenues which divert wet-weather flows. Dry-weather flow enters the Richmond sewer tunnel which begins at 24th Avenue and Lake Street and cuts through the Richmond area diagonally to Fulton Street and 35th Avenue. From this point, the flow continues westerly to a diversion structure at 41st Avenue. At 46th Avenue, this flow joins other flows from the lower part of Richmond area going southwesterly to the Richmond-Sunset WPCP in Golden Gate. Dry-weather flows from the Palace of the Legion of Honor and a portion of Lincoln Park are led into the California Street sewer flowing eastward and into the diversion structure at 24th Avenue and Lake Street. A leaping weir at this point allows dry-weather flows to drop into the sewer tunnel for transport to the Richmond-Sunset Plant.

Dry-weather flows in the Seacliff area are handled by pumping and gravity. The major sewer interceptor is a 6' diameter conduit which is the continuation of the 24th Avenue outfall. Dry-weather flows from the western part of Presidio are pumped to El Camino Del Mar and 25th Avenue by a lift station and discharged into the 6' diameter collector. From this point, the flows are transported to a

diversion structure, the flows are funneled into Sea Cliff Pump Station No. 2 located just north of 26th Avenue on Seacliff Avenue. The area just north of Seacliff Avenue between 29th and 32nd Avenues is lower than the surrounding area and the dry-weather flows are pumped to a point at Sea Cliff Avenue just north of El Camino del Mar by Sea Cliff Pump Station No. 1. Here the flows go through a diversion structure at 26th Avenue and into Sea Cliff Pump Station No. 2. An area of approximately 8 acres just east of Pump Station No. 2 is drained directly into the pump station. All the dry-weather flows from Pump Station No. 2 are discharged at 25th Avenue and Lake Street into the sewer tunnel and then transported to the Richmond-Sunset Plant. All the dry-weather flows are treated at the plant and the effluent is discharged by gravity into the Pacific Ocean through the SWOO via the Westside Transport.

#### **Lake Merced Transport Service Area Wet-Weather (WW) System Configuration (See Figure 5-1)**

When rainfall intensity exceeds .02 inches per hour for a period of time, the designed capacity of the DW sewerage would be exceeded, and the diversion/control structures east of 19th Avenue in Lyndhurst Drive and east of Junipero Serra Boulevard in Brotherhood Way function to divert the excess flows into the larger WW sewers flowing westerly across 19th Avenue. At the same time combined flows originating in the small residential area north of Lake Merced (bounded by Lake Merced, Sunset and Sloat Boulevards and Springfield Drive, Ocean Avenue, and Meadowbrook, Eucalyptus and Middlefield Drives) is conducted easterly by gravity along the north shore of Lake Merced then southeasterly to a point on the SFSU campus underneath a multi-story parking garage where these flows are joined by those from the diversion control structure located in Lyndhurst Drive. These two merging flows also receive WW runoff from both the Stonestown Shopping Center and the SFSU Campus.

All the flows meeting the junction under the SFSU parking garage are led southward by gravity through a deep 10'-0" x 11'-3" horseshoe sewer tunnel. Under Brotherhood Way this tunnel receives the WW flows from the southern diversion/control structure east of Junipero Serra Boulevard. These combined flows are taken southwesterly to a point under Lake Merced Boulevard where another junction adds the WW flow from the Park Merced apartment complex. A large 3-compartment reinforced concrete storm sewer takes all these flows across Lake Merced to the overflow/diversion structure under John Muir Drive just upstream of the LMPS. The flow in excess of the 6.77 MGD capacity of LMPS overflows into a westerly flowing 10'-0" x 11'-3" gravity tunnel which discharges onto and across the beach

at the foot of the Fort Funston bluffs.

#### **Richmond Transport Service Area Wet-Weather (WW) System Configuration (See Figure 5-2)**

When rainfall intensity exceeds approximately .02 inches per hour for a period of time, the designed capacity of the dry-weather sewerage system would be exceeded. Under these conditions, the diversion/control structures on Lake Street at 17th and 22nd Avenues divert the excess flows into 6.5' and 5.5' diameter outfall conduits flowing northerly to Baker Beach. Remaining flows will move westward into the diversion structure at 24th Avenue and Lake Street.

At the same time, combined flows originating from the central Richmond area including Lincoln Park and flows from the diversion structure at 22nd Avenue drop into the sewer tunnel. Excess flows drain into the 6' diameter sewer which transports the flows into the diversion structure at Seacliff Avenue and 26th Avenue. At the same time, flows from Pump Station No. 1 and flows from most of the Seacliff area merge together at the diversion structure. Flows in excess of Pump Station capacity continue northward and are discharged at Phelan Beach with the remainder of the flows going into Pump Station No. 2. The eight acre area east of P.S. No. 2 has three small overflow points. These overflows are discharged at Phelan Beach when the pump station capacity is exceeded. A 15-inch diameter emergency overflow is also located at the sump area of the pump station to prevent the pump station from flooding in case of malfunction. All the combined flows at the Pump Station No. 2 are discharged into the sewer tunnel at Lake Street and 25th Avenue. Combined flows reaching the tunnel are transported down to 48th Avenue and Fulton Street for discharge into the WST when the capacity of the Richmond-Sunset Plant is exceeded.

#### **CITY WATER POLLUTION CONTROL MANAGEMENT**

Water pollution control for the City and County of San Francisco is administered by the Department of Public Works. Under this Department, the San Francisco Clean Water Program is responsible for planning, design, and construction of water pollution control facilities, as well as financial and grant administration, affirmative action, and public affairs activities related to water pollution control. The Bureau of Water Pollution Control is responsible for the planning, design, operation, and maintenance of wastewater treatment and disposal facilities.

Water pollution control policy decisions are made by the Mayor, the Chief Administrative Officer, and the City's elected Board of Supervisors.

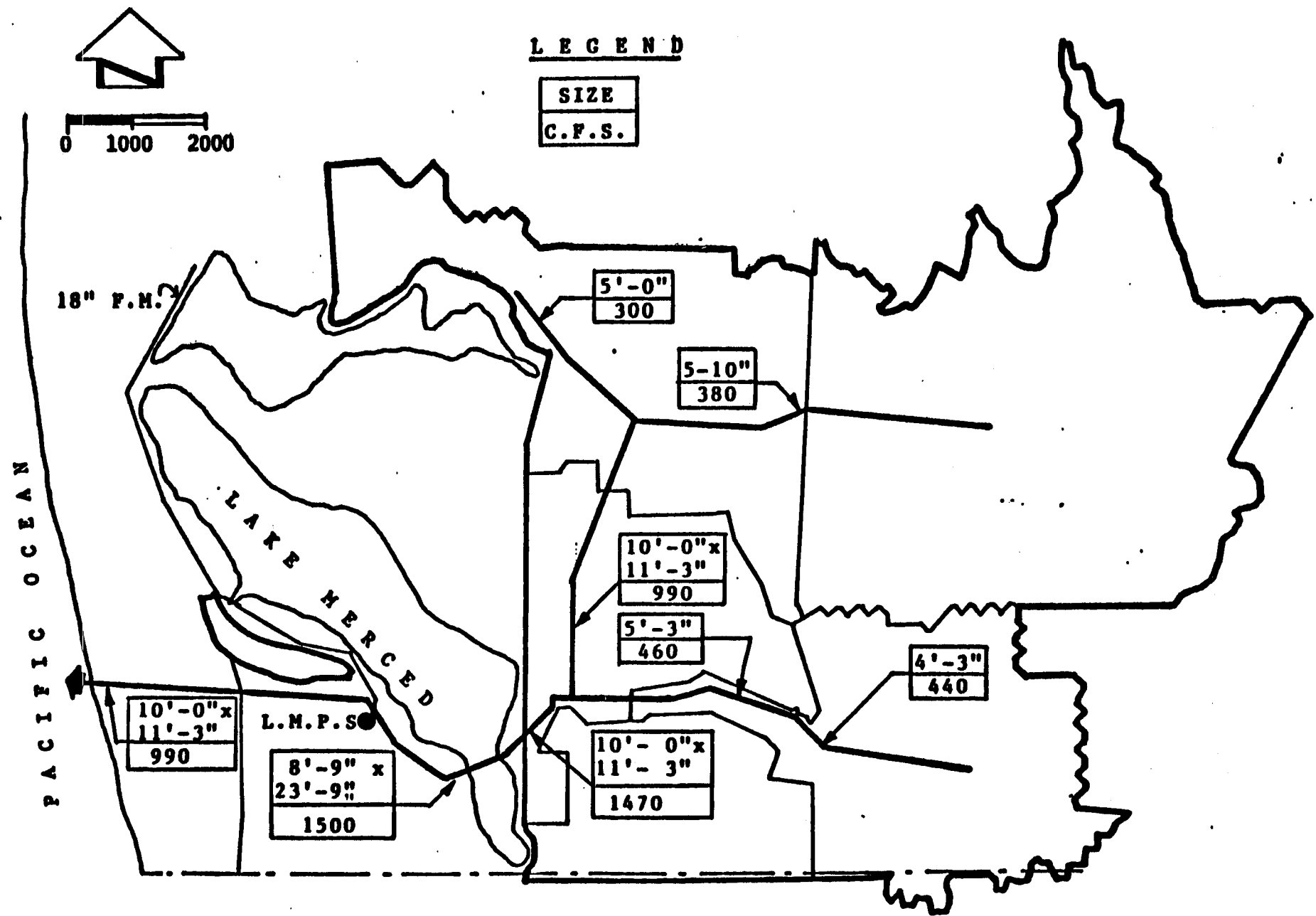


FIGURE 5-1 LAKE MERCED TRANSPORT SEWER SERVICE AREA ( MAJOR SEWERS)

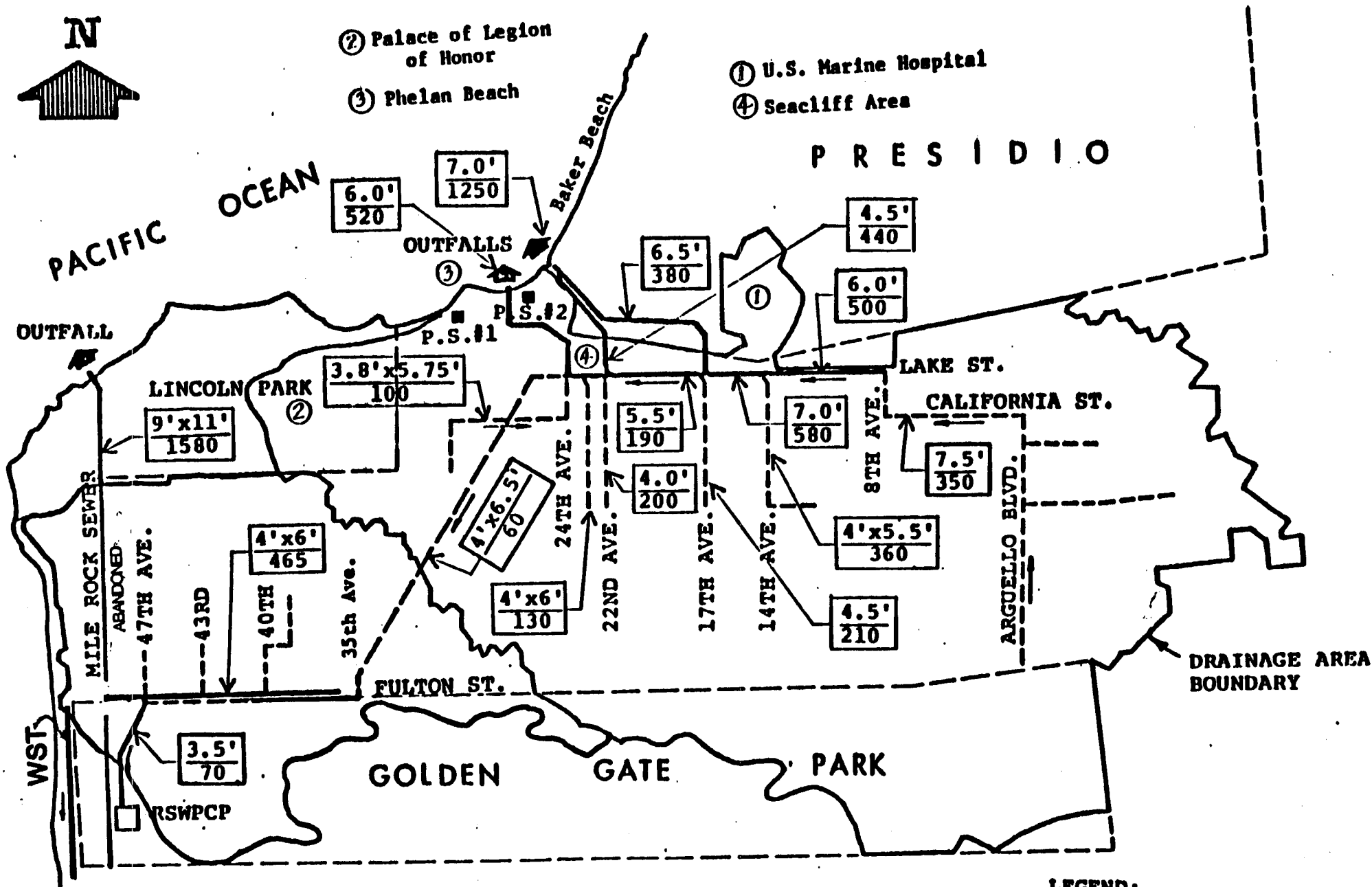
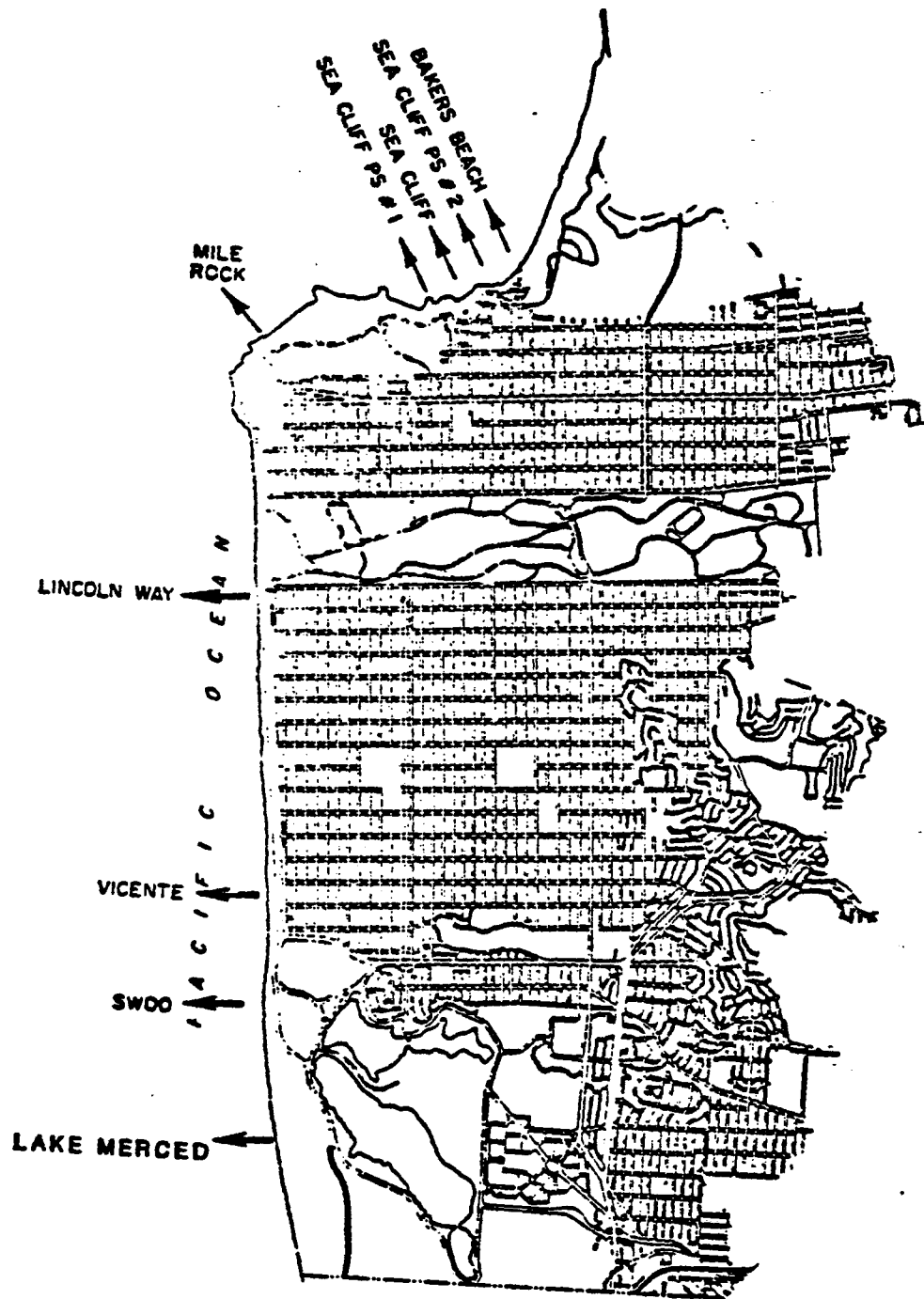


FIGURE 5-2  
MAJOR COLLECTOR SEWERS WITHIN THE  
RICHMOND TRANSPORT SERVICE AREA

Figure 5-3  
LOCATION OF WESTSIDE OUTFALLS





## **CHAPTER 6 WASTE DISCHARGE REQUIREMENTS**

### **WET WEATHER DISCHARGE REQUIREMENTS**

On March 16, 1976, the State Water Resources Control Board adopted Order No. 76- 23, subsequently modified by Order No. 79-12, in January 1979, NPDES Permit No. CA0038415 (Appendix A). The permit prescribed discharge requirements and required the City to design and construct facilities to reduce combined sewer overflows. The facilities must reduce the combined overflows to provide for a long- term average of eight overflows per year through the existing diversion structures along Ocean Beach and the shoreline within the Richmond-Sunset sewerage zone.

In June 1988, the RWQCB established the following schedules in Order No. 88-105 for completion of projects to deal with untreated overflows for Lake Merced and Richmond (Seacliff and Baker's Beach) dimension structures:

#### **LAKE MERCED TRANSPORT RICHMOND TRANSPORT**

|                                    |         |        |
|------------------------------------|---------|--------|
| Complete environ-<br>mental review | 6-1-89  | 2-1-89 |
| Complete design                    | 10-1-90 | 4-1-91 |
| Start construction                 | 4-1-91  | 8-1-92 |
| Complete construction              | 11-1-92 | 9-1-94 |
| Full compliance                    | 9-1-94  | 9-1-94 |

One of the requirements governing the allowability of an overflow is that the "City- wide treatment facilities, excluding the Golden Gate Park reclamation facility, are operated at capacity or some lower rate consistent with the maximum withdrawal and transport rates."

The new Westside treatment facilities should treat a maximum sustained flow of 45- mgd during wet weather conditions. An operational maximum flow will be established during wet weather events to prevent plant upsets during a storm and dewatering and flushing of the WST facilities after a storm. The WSPS will discharge about 112 mgd of decanted wet weather flow via the SWOO. The flow through the SWOO will total 155-160 mgd with the addition of effluent flow from the Westside treatment facilities. Wet weather is defined as the time between commencement of rainfall and termination of dewatering of the WST facilities.

It is expected that the West Side wet weather discharge will meet State Ocean Plan standards with the following conditions:

- o SWRCB Resolution No. 80-38 approved an exemption from the 75 percent suspended solids removal requirement of the 1978 Ocean Plan for the intended treated wet weather discharge to the ocean. The suspended solids exemption will continue to be in effect for the 1990 Ocean Plan.
- o An analysis of Bayside overflow data for the 1984-85 and 1985-86 rainy seasons indicates that in 3- to 4-hour composite samples collected at the five Northshore overflow monitoring stations a total suspended solids concentration of 57 mg/l or less occurred 50 percent of the time. Similarly, in 3- to 4-hour composite samples collected at the two Channel Creek overflow stations TSS concentrations of 66 mg/l or less occurred 50 percent of the time. In addition, at both the North Shore and Channel overflow stations G/O concentrations less than or equal to 9mg/l occurred 50 percent of the time.
- o One of the difficulties in attempting to interpret the Ocean Plan standards for wet weather operation (which are established for governing continuous or long-term discharges) is the intermittent and short duration nature of wet weather occurrences. This was recognized in 1980 at the time of preparations of the Southwest Plant Final Project Report. Appendix QQ of that report established assumptions that were discussed with the RWQCB staff at that time regarding compliance with Ocean Plan standards for the then proposed SWWPCP wet weather effluent discharge.

"Full-storm composites" were proposed as the principal performance evaluation sample and the sample period was defined as the startup and shutdown of the Southwest wet weather plant. The 30-day average requirement was not considered applicable since the expected discharges were of a short duration.

Discharge requirements from the Westside Transport thru SWOO and from the new treatment plant are detailed in the 301 (h) Modified NPDES Permit issued by EPA in July 1988, effective August 9, 1988 (unless appealed). Excerpts from this permit with regard to Discharge Prohibitions, Effluent Limitations, and Receiving Water Limitations, are included in Appendix B.

## **CHAPTER 7**

### **PROJECT ALTERNATIVE ANALYSIS**

#### **LAKE MERCED PROJECT**

#### **INTRODUCTION**

The project alternatives for the Lake Merced Transport Project area are developed, described and analyzed in this chapter. The effort included the review of previous San Francisco Wastewater Management reports, examination of existing conditions (No-Project Alternative), development of alternative projects, screening of alternatives and detailed analysis of the more viable alternatives.

Volume II of this report describes the Richmond Transport Project.

The detailed analysis of the more viable alternatives is based on a number of factors which include: conformance with identified constraints, cost effectiveness, monetary cost, environmental impacts, social impacts, and other considerations such as: scarce resources, flexibility and reliability, bypass conditions, flood protection provisions, compatibility with local planning and land use and ability to implement. With these factors as guides, the most promising alternatives are further reduced and compared.

#### **DEVELOPMENT OF INITIAL ALTERNATIVES**

##### **Previous Reports**

This section traces the historical development of wastewater management programs for the City of San Francisco in the Lake Merced Transport project area in six previous reports.

##### **SAN FRANCISCO MASTER PLAN, SEPTEMBER 1971.**

The San Francisco Department of Public Works prepared a report that presented a program for the management of wastewater flow for the City. The primary objectives of the program were to (1) upgrade the City's wastewater treatment level, (2) reduce the frequency and volume of wet-weather overflows.

In the Lake Merced Transport project area, the following are the main components: 1. Lake Merced Tunnel and Retention Basins 2. New Lake Merced Treatment Plant 3. Lake Merced Wet Weather Diffusers.

These three components are to be interconnected with the whole system with the potential result of reducing overflows to eight (8) per year. (See Figure 7-1). (The RWQCB subsequently, in 1976, mandated one overflow per year.)

## **WATER QUALITY CONTROL PLAN SAN FRANCISCO BAY BASIN PLAN, APRIL 1975**

The RWQCB reviewed the San Francisco Master Plan and incorporated it into this report also known as the Basin Plan. The RWQCB concluded in this report that the Master Plan program would meet water quality objectives for receiving water and would be consistent with the RWQCB plan of action, which consisted of two phases.

As part of Phase I the existing Richmond-Sunset WPCP would be upgraded with effluent disposal through a new Ocean Outfall from the Lake Merced site.

In Phase II, the wastewater flow management system for the City would be completed. Storage facilities throughout the City would provide wet weather overflow control. A wet weather treatment plant at the Lake Merced site on the Westside would treat Westside and Southeast wet weather flows.

## **OVERVIEW FACILITIES PLAN, AUGUST 1975**

The Overview Facilities Plan was prepared by J.B. Gilbert & Associates for the San Francisco Department of Public Works. The report reviewed the 1971 Master Plan and the existing wastewater flow management system. Refinements of the 1971 Master Plan program provided the basis of the definitive projects for wastewater flow management.

Proposed facilities in the Lake Merced Transport area included storage basin to hold wet weather flows until the flows could be transported through a force main to the proposed Southwest WPCP for treatment. (Figure 7-2).

## **WESTSIDE WET WEATHER FACILITIES REVISED OVERFLOW CONTROL STUDY, DECEMBER 1978**

The San Francisco Clean Water Program prepared a report to the Regional Water Quality Control Board which presented statistical data covering the costs and benefits of different levels of overflows in the Westside zone of the City. In this report the City requested that the number of annual wet-weather combined-sewer overflows be increased from one to eight as a way to provide large capital and maintenance cost savings with only a slight reduction in water quality. (The RWQCB in 1979 revised its requirement to eight overflows.)

## **SOUTHWEST WATER POLLUTION CONTROL PLANT PROJECT, FINAL PROJECT REPORT, FEBRUARY 1980**

The firm of Metcalf & Eddy, Inc. (M&E), was retained to perform facilities planning for the Southwest Water Pollution Control Plant Project. In their February 1980 final project report, M&E recommended the initial capacity of various transport project facilities throughout the City including Lake Merced Transport (see Figure 7-3). As a result of M&E's recommendation, projects on the oceanside of the City became interdependent, but component projects proceeded on different schedules.

## **WESTSIDE WATER POLLUTION CONTROL FACILITY PLANNING REPORT, JANUARY 1988**

The San Francisco Clean Water Program prepared a report to the State Water Resources Control Board to identify the best apparent alternative for the treatment of Westside flows to meet Federal and State discharge requirements and to determine the actual location of the facilities. The report recommended a treatment facility at the site south of the zoo consisting of pretreatment, primary treatment, high purity oxygen activated sludge secondary treatment and solids handling facilities. Discussed also within the report is wet-weather treatment for Westside flows and treatment required if the City's ocean waiver application is approved by EPA.

## **STAGED IMPLEMENTATION OF MASTER PLAN**

Due to the scarcity of Federal funds in the mid eighties the City developed a staged implementation of the Masterplan. Thus, soon after construction of the Westside Transport (WST), the West Side Pump Station (WSPS) and the Southwest Ocean Outfall (SWOO), the central westside system was activated to bring the Ocean Beach area to compliance with overflow reduction requirements. Wet weather flows from the central part of westside, specifically Fulton Street, Lincoln Way and Vicente Street sewers, are intercepted by the WST. In the absence of the SWWPCP proposed by the Masterplan, a decanting process was adopted. Flow in excess of the RSWPCP capacity is baffled, decanted and pumped to the SWOO by the WSPS.

To conform to the decant mode of operation, a matrix of sizes for the Lake Merced Transport facilities was developed (see Appendix C). The results of the hydrologic analysis are presented in Table 7-1. Columns 3 and 4 show the total storage and pumping requirements in Lake Merced for various Richmond storage/pumping combinations (See columns 1 and 2).

Subsequent conjunctive evaluation of the Richmond Transport (RT) and Lake Merced Transport (LMT) alternatives, led to the conclusion that the most viable RT alternative is that with a 9.5 MG storage and an average withdrawal rate of 51 MGD, shown in Group 'B' in Table 7-1. From this point on, only LMT alternatives compatible with this most viable RT alternative are considered.

Based on the facility requirements and planning criteria, eight initial alternatives were developed for Lake Merced. One alternative was the no project alternative. The remaining seven alternatives (Fig. 7-5 & 7-6) were generally categorized as gravity-dependent or pump-dependent system.

#### **NO PROJECT ALTERNATIVE**

This alternative is a case in which no action is taken and existing Lake Merced facilities are retained. Obviously, the no project alternative will not reduce storm-related overflows below their present annual frequency of 58 times per year. Thus, National Pollutant Discharge Elimination System (NPDES) permit requirements calling for a reduction of overflows to an average of eight per year would be violated. This alternative, therefore, is not retained for further analysis.

#### **PUMP-DEPENDENT ALTERNATIVES WITH STORAGE BASIN**

Alternative #1 - place a storage basin facility in John Muir Drive, an upgraded Lake Merced Pump Station (LMPS) and a force main from LMPS north to John Muir Drive, Skyline Boulevard, Great Highway Extension to the Westside Transport (WST). Under the existing WST "decant plus treatment" scenario the storage basin volume would be 9.2 MG and the LMPS would pump at 25 MGD.

Alternative #2 - place a storage basin facility with decanting capabilities in John Muir Drive, an upgraded LMPS and a force main from the LMPS north to John Muir Drive, Skyline Boulevard, Great Highway Extension to the SWOO. The storage basin volumes will be identical to those in Alternative #1, increased by approximately 1.8 MG to accommodate LM decanting. LMPS pumping rates are identical to those in Alternative #1.

Alternative #6 - place a storage basin facility in John Muir Drive, an upgraded LMPS and a force main from LMPS north to John Muir Drive, Skyline Boulevard, ZOO Road, Sloat, to the Westside Transport. Storage basin volumes and LMPS pumping rates are identical to those in Alternative #1.

Alternative #7 - place a storage basin facility in John Muir Drive, an upgraded LMPS and a force main from LMPS north to John Muir Drive, Skyline Boulevard, Zoo Road, Great Highway to the Westside Transport. Storage basin volumes and LMPS pumping rates are identical to those in Alternative #1.

#### **GRAVITY-DEPENDENT ALTERNATIVES**

The main features of all gravity-dependent alternatives include a large diameter tunnel, an upstream diversion/control structure and a downstream connection to the Westside Transport. The tunnel diameter depends on the tunnel length, which may vary with tunnel alignment, and the required storage volume, i.e. 9.5 MG, compatible with the current WST "decant plus treatment" scenario.

Alternative #3 - construct a 13.5' diameter tunnel starting at the existing Lake Merced Pump Station (LMPS) and following John Muir Drive, then Skyline Boulevard and Great Highway to Westside Transport.

Alternative #4 - construct a 13.5 diameter tunnel from the west end of existing Lake Merced Outfall tunnel north along the shore to the Westside Transport.

Alternative #5 - construct a 12' diameter diameter tunnel starting at around Brotherhood Way and Lake Merced Boulevard, and across Harding Park, in a northwesterly direction to Skyline Boulevard. Then along Skyline Boulevard in a northerly direction for about 700 feet from which point the tunnel would be routed to the Westside Transport in a straight line.

#### **INITIAL SCREENING OF ALTERNATIVES**

Initial screening of the alternatives led to the elimination of three alternatives, Alt. #5, Alt. #6 and Alt. #7, primarily as a result of impact to the surrounding area during construction, construction cost, or problems with public acceptability.

Any alternative which indicated open-cut construction in roadways immediately easterly or westerly of the Recreation Center for the Handicapped were eliminated because they were either longer or the same length as the Great Highway alternative and would be more disruptive to construct than a Great Highway alignment. Thus Alternatives #6 and #7 were eliminated. (See Figure 7-4).

The gravity tunnel through Harding Park, Alternative #5, was eliminated because it was longer than the John Muir Drive alignment and had the potential for construction problems through the narrow isthmus entry to Harding Park. Furthermore, the Coastal Commission did not favor this solution because of the disruption to the heavy recreational use of these facilities. (See Fig. 7-5)

Final Alternative #1 is a pump-dependent solution with a storage basin. Alternative #2 is a pump-dependent solution and a storage basin with decanting capabilities. Alternatives #3 and #4 are gravity-dependent solutions.

#### **SECOND SCREENING, ALTS. #1, #2, #3 AND #4**

Alternative #4, the Shoreline Tunnel Alignment, was eliminated because of the difficulty in building and maintaining a weir structure 200 feet long, either at the mouth of the existing Lake Merced Outfall or at the junction of the new and old tunnels. Also, a shoreline weir would aggravate the already sensitive upstream hydraulic conditions. Furthermore, the GGNRA and the Coastal Commission would not approve construction of the weir.

The City has no easement for the weir and National Park Service policy, as stated by local GGNRA representatives, precludes new structures on beaches. Obtaining an easement would require political intercession at the Federal level which is unlikely since there are better alternatives available. The State Coastal Commission supports GGNRA.

The three remaining alternatives were retained for further evaluation. Alternative #1, a pump-dependent solution, Alternative #2, a pump-dependent solution with a storage basin and decanting capabilities, and #3 a gravity-dependent solution.

The evaluation procedure used to compare the final alternatives consists of ranking each alternative against the set of evaluation factors developed originally by Metcalf and Eddy. These factors include cost, energy consumption, land requirements, traffic impacts,

flexibility, reliability, implementability, and public acceptability. The importance of each factor was considered and a comparison was made of a series of trade-offs between the advantages and disadvantages of each alternative against other alternatives. Comparison of the three remaining alternatives led to the selection of the Apparent Best Alternative and is discussed in the following chapter.



## **SELECTED ALTERNATIVES**

### **Alternative LM-1: Great Highway Road Force Main to WST**

Under this alternative, a storage basin would be constructed under John Muir Drive to retain flows that exceed the dry weather pumping capacity of the modified Lake Merced Pump Station (see Figure 7-7).

The basin would be approximately 32 feet deep, 35 feet wide and 1200 feet long all inside dimension and would have a storage capacity of 9.2 million gallons. The basin would be constructed along the alignment of the existing three-compartment sewer line and would replace the current structure starting from where it crosses John Muir Drive and extending to the Lake Merced Pump Station.

A diversion control structure would be constructed alongside of storage basin as an additional compartment to the basin to divert flows exceeding the capacity of the modified LMPS and storage basin into the existing Lake Merced outfall (LMO). This underground structure would be approximately 8 feet high, 11 feet wide and 200 feet long.

The existing 6.8 million gallons per day (mgd) Lake Merced Pump Station (LMPS) would be modified to increase capacity to 25 mgd. Additions would be constructed north and west of the existing pump station. The concrete structure would require excavations extending approximately 50 feet below the ground surface and the completed structure would extend about 28 feet above grade.

A new force main would be constructed from the Lake Merced Pump Station (LMPS) to the southern terminus of the recently completed West Side Transport (WST) system. The force main would be 36 inches in diameter, extend approximately 9,000 feet in length. The main would extend along John Muir Drive to Skyline Boulevard, along Skyline Boulevard to Great Highway, then along Great Highway to intersection with the WST east box. The force main would be constructed under the western section of the roadways and would not disturb the existing 18-inch force main, which would continue to transport dry weather flow.

As part of the proposed project, an additional pump of 20 to 25 mgd capacity would be constructed as an addition at the north side of the existing Westside Pump Station (WSPS).

All new facilities comprising alternative 1 would be built using cut and cover excavation. The storage basin, expanded pump station and connection structures would likely be constructed using open, braced excavations requiring dewatering during construction. Completion of these components of the project would be expected to take approximately 530 working days in total.

The proposed new force main would be placed in braced excavations about 6 feet wide with a total construction zone of 18 feet wide and is expected to take from 10 to 15 months to complete. To minimize the length of local roadways under construction at any one time, the linear components of the project, such as the storage box and the force main, would be built in segments, probably 400 to 500 feet long.

#### **ALTERNATIVE LM-2: FORCE MAIN TO SWOO**

Under this alternative, instead of being directed to the WST structure, the new force main would be routed directly to the South West Ocean Outfall (SWOO) which runs seaward from the Great Highway (see Figure 7-8). Up to this point, the new force main would follow the same route as alternative LM-1. Overall length of the force main from the LMPS to the South West Ocean Outfall would be approximately 6,200 feet, requiring 8 to 10 months for construction. The other components of the project would remain the same as alternative LM-1, except that a new pump would not be constructed at the existing Westside Pump Station and the size of the Lake Merced storage basin would be increased in order to provide for decanting of combined Lake Merced flows. The basin would be expanded by 200 feet in length for a total capacity of 11 million gallons.

#### **ALTERNATIVE LM-3: GRAVITY TUNNEL TO WESTSIDE TRANSPORT**

Under this Alternative, Lake Merced wet weather flows would be routed to the Westside Transport (WST) box via a large diameter gravity tunnel, thereby eliminating the need for a storage basin, expanded Lake Merced Pump Station and force main (see Figure 7-9).

The tunnel, which would be constructed underground by conventional tunneling methods would be approximately 13.5 feet inside diameter and 8,600 feet long. The tunnel and related structures would have a storage capacity of 9.5 million gallons. The alignment follows the road easement, which is up to 60 feet wide.

A diversion control structure with weir length of 200'+ would be constructed along John Muir Drive near the existing pump station and using the tunnel exit shaft as part of the structure. This will divert flows from the Lake Merced sewer into the tunnel for storage and transport to the WST box. When the available storage and/or tunnel capacity is exceeded, the excess flow will overflow the weir and discharge into the ocean via the Lake Merced outfall.

As part of this alternative, an additional pump of 20 to 25 mgd capacity would be constructed as an addition within the north side of the existing Westside Pump Station. The existing Lake Merced pump station will be abandoned. All DW and WW flows from the entire Lake Merced watershed, including those East of Junipero Serra Boulevard now routed to the RSWPCP through Stonestown by gravity, will be routed to the WST through the proposed tunnel.

A construction staging area of about 120'x200' and the tunnel construction access shaft would be located at the GGNRA parking lot on the west side of the Great Highway at Sloat Blvd. The tunnel access shaft would have dimensions of 30'x60'x40' deep. A five-foot diameter pipe would be jacked at a 90-degree angle to the tunnel alignment under the Great Highway to the west wall of the Westside Transport at Sloat Boulevard. This five-foot pipe would pass through the west and central walls of the Westside Transport and allow the contents of the tunnel to spill in the sump area of the east compartment.

Underground tunneling would proceed from the tunnel shaft at the GGNRA parking lot, under the Great Highway Extension, Skyline Boulevard, and John Muir Drive until it reached a point adjacent to the existing Lake Merced Pump Station (see Figure 7-8). At this point a shaft measuring approximately 25 x 35 x 30 feet deep would be constructed for removal of tunneling equipment at the completion of the project. This shaft would be located in the west side of John Muir Drive adjacent to the Lake Merced Pump Station. An excavation approximately 50 feet wide and 35 feet deep would then extend for about 200 feet southward along John Muir Drive to allow construction of a control structure for overflow of wastewater to the existing Lake Merced ocean outfall tunnel during extreme wet weather conditions.

The entire length of the structures will be in sand deposits. Up to about 25 feet of clean to silty, loose to medium sand fill exists along the Great Highway. This fill is underlain by recent dune sand or slightly cemented, dense sands of the Colma formation. The dune and Colma sands prevail along the remainder of the route along Skyline Boulevard and John Muir Drive. For the most part, the tunnel would be in the Colma formation, with some excursions into the looser, uncemented dune sands. The soil conditions are described in greater detail in Harding-Lawson Associates' report "Preliminary Geotechnical Investigation, Lake Merced Transport Project", dated July 28, 1981.

At the northern end of the route, the groundwater table is about two to three feet above the crown. At the southern end, however, the groundwater table is at the invert, and most of the alignment shows the groundwater table within the height of the tunnel. The groundwater is fresh and the groundwater table controlled by seepage from Lake Merced and inland catchment areas.

#### **ALTERNATIVE CONFORMANCE WITH IDENTIFIED CONSTRAINTS**

The three selected alternatives must conform with existing state and federal regulations. In particular, they must agree with the Basin Plan, comply with NPDES discharge permits and also meet short and long-term goals and objectives mentioned in Chapter 1.

##### **Basin Plan**

All three alternatives conform with the water quality objectives, waste load restrictions and ocean discharge of waste water flows.

##### **NPDES Discharge Permits**

All three alternatives will comply with dry-and wet-weather initial dilution and receiving water quality limits identified in Chapter 6, and Appendices A and B.

##### **Possible Future Constraints**

Should wet-weather overflow requirements become more stringent, facilities in all the selected alternatives could not comply. Any facility upgrading and/or construction that may be needed later would require additional expenditures.

#### **COST-EFFECTIVENESS ANALYSIS**

The cost effectiveness analysis is an assessment of the monetary costs and environmental effects of the three selected alternatives. This analysis includes the capital costs of construction, operation and maintenance costs, and energy costs.

According to U.S. Environmental Protection Agency (USEPA) guidelines, contained in Appendix A of 40 CFR 35, printed in the Federal Register, Volume 43, No. 188, dated September 27, 1978, total present worth or equivalent annual costs must be used in the cost-effectiveness analysis to determine which alternative facility will result in the minimum total cost over time to meet federal, state, or local requirements. Inflation, except for land and natural gas, cannot be considered in the cost-effectiveness analysis.

Federal guidelines require that costs be estimated on the basis of prices prevailing at the time at which the cost-effectiveness analysis was begun, which was March 1987 for this study. Also, the guidelines require that the cost-effectiveness analysis be based on a 20-year planning period commencing from the initial operation of the system. For the Lake Merced Facilities Planning Project, the planning period will begin when Lake Merced Facilities become operational on July 1, 1991.

The useful life of all facilities will be 50 years except for pumps and other mechanical and electrical equipment. Pumps and mechanical and electrical equipment will have useful lives of 20 years. Depreciation will be calculated by the straight-line basis with no salvage value at the end of the useful life. The value of land will appreciate rather than depreciate. Sunk costs, such as existing facilities, outstanding indebtedness, or this planning study are not considered.

In preparing the present worth or equivalent annual cost estimates, consideration of the time value of money is made by using a discount factor established annually by the U.S. Water Resources Council. The discount rate of 8-7/8 percent per annum, applicable to this study, was published in the Clean Water Program Bulletin.

Escalated project costs, which are the actual costs of implementing and operating the facility, including the increased costs due to inflation in construction and related services, are not presented in this report because federal and state funding uncertainties make development of firm implementation schedules unrealistic. These costs recognize when facilities are scheduled for construction and when services are required in the future by inflating costs to those times.

Contract cost estimates, which are estimates of a contractor's bid price, were prepared for each alternative based on historical construction costs for similar facilities and updated by use of the Engineering News-Record (ENR) Construction Costs Index, which is computed from actual prices of construction material and labor. The Construction Cost Index for San Francisco in March 1987, the base date for the cost-effectiveness analysis, was approximately 5513.

Construction contingencies are to cover extra costs that are unforeseen at the time the estimate is prepared. There are two sources of these costs. First, the low contract bid may be higher than the cost estimate. Second, some contract change orders will inevitably occur during the construction period. Change orders are usually caused by one or more problems such as unanticipated subsurface conditions, interference with utilities, and time delays. The amount of unknowns generally decrease as planning and design progresses from the conceptual stage to final design; therefore, the amount of the construction contingencies is correspondingly decreased. For this project, the contingency has been estimated at 10 percent during the analysis of final alternatives.

Professional services include design engineering, office engineering during construction, construction inspection, administration, legal work, affirmative action, public information, and start-up and training programs. Professional services historically have approximated the following percentages of construction cost, excluding contingencies:

#### Engineering

|   |                   |
|---|-------------------|
| Design  | 6 percent         |
| Office engineering during construction                                  | 1 percent         |
| Construction inspection   | 5 percent         |
| Soils, surveys, and materials testing                                   | 1 percent         |
| Legal work administration, affirmative action, and public participation | 2 percent         |
| Start-up and training   | <u>1 percent</u>  |
| <b>TOTAL</b>  | <b>16 percent</b> |

is the sum of contract cost, construction contingency cost, professional services cost, land cost, and the cost of interest during construction (using a discount rate of  $8\frac{7}{8}$  percent per annum).

**TABLE 7-2**

**EXAMPLE WITHOUT INFLATION  
LAKE MERCED TRANSPORT  
ALTERNATIVE LM-1**

**Important Dates**

|   |               |
|---|---------------|
| Cost-effectiveness analysis                           | March 1, 1987 |
| Start construction                                    | July 1, 1989  |
| Complete construction and start of<br>planning period | July 1, 1991  |
| End of planning period                                | July 1, 2011  |

**Capital Cost**

Construction at ENR = 5513 (including contractor's bonds,  
insurance, overhead and profit)

|   |                  |                   |
|---|------------------|-------------------|
| Structures  | 16,570,000       |                   |
| Mechanical  | <u>1,950,000</u> | \$18,520,000      |
| Contingency (20%)   |                  | 3,700,000         |
| Professional services (16%)   |                  | <u>2,960,000</u>  |
| Subtotal  |                  | \$25,180,000      |
| Interest $1/2 \times 2 \text{ yrs} \times \$25,180,000 \times 0.08875 =$                    |                  | <u>2,230,000</u>  |
| Total Capital Cost  |                  | \$27,410,000      |
| Salvage Value   |                  |                   |
| Structures $((50-20)/50) \times \$27,410,000 \times$<br>$(16.57/18.52) \times (0.182573) =$ |                  | <u>-2,690,000</u> |
| Capital Cost Less Salvage Value   |                  | \$24,720,000      |

**O&M Cost**

|   |                             |                     |
|---|-----------------------------|---------------------|
| Labor & Materials   | 16,000/yr.                  |                     |
| Energy (electrical)                                       | <u>40,000/yr.</u>           |                     |
| Total O&M Cost  | \$200,000/yr.               |                     |
| PW of O&M   | $\$200,000 \times 9.2104 =$ | <u>\$ 1,840,000</u> |
| TOTAL PRESENT<br>WORTH COST                               |                             | \$26,580,000        |
| EQUIVALENT ANNUAL<br>COST $\$26,580,000 \times 0.10857 =$ |                             | \$ 2,885,000        |

Operation and maintenance costs are separated into three categories: (1) labor, (2) equipment and materials; and (3) energy. Cost estimates for labor, equipment, and materials were based on City records and historical experience from other similar wastewater facilities. Cost estimates for energy consumption were calculated for the specific installations under evaluation.

The table below compases the final alternatives:

**TABLE 7-3**

**SUMMARY OF COMPARISON  
LAKE MERCED FINAL ALTERNATIVES  
(\$ = Millions)**

| ITEM NO. | DESCRIPTION                      | LM-1    | LM-2    | LM-3    |
|----------|----------------------------------|---------|---------|---------|
| 1A       | Structures                       | \$16.57 | \$17.68 | \$20.95 |
| 1B       | Mechanical & Electrical          | 1.95    | 1.50    | 0.45    |
| 1        | Structures & Mechanical & elect. | 18.52   | 19.18   | 21.40   |
| 2        | Contingency (20%)                | 3.70    | 3.84    | 4.28    |
| 3        | Professional Services (16%)      | 2.96    | 3.07    | 3.42    |
| 4        | Subtotal                         | 25.18   | 26.09   | 29.10   |
| 5        | Interest                         | 2.23    | 2.32    | 2.58    |
| 6        | Total Capital Cost               | 27.41   | 28.41   | 31.68   |
| 7        | Salvage Value                    | (-)2.69 | (-)2.87 | (-)3.40 |
| 8        | Capital Cost Less Salvage Value  | 24.72   | 25.54   | 28.28   |
| 9        | Annual Energy                    | 0.04    | 0.03    | 0       |
| 10       | Annual Labor & Materials         | 0.16    | 0.17    | 0.01    |
| 11       | Total Annual O&M                 | 0.20    | 0.20    | 0.01    |
| 12       | Present Worth of O&M             | 1.84    | 1.84    | 0.127   |
| 13       | Total Present Worth              | 26.58   | 27.38   | 28.4    |
| 14       | Equivalent Annual Cost           | 2.89    | 2.97    | 3.08    |

Appendix D provides detailed, itemized cost estimates for these alternatives.



## **SOCIAL AND ENVIRONMENTAL IMPACT ANALYSIS**

All three alternatives have potentially greater positive than negative impacts on the social environmental resources of the Lake Merced area.

### **Social Impacts**

All the transport project alternatives will enhance beach recreation along Ocean Beach. Improvement of discharge quality, and reductions in overflows should lead to an overall increase in swimming, diving, sailing, boating, and similar water uses.

Another positive social impact of the proposed alternatives is that the construction money expended would have subsequent demand for secondary goods and services.

### **Environmental Impacts**

Environmental impacts for the three alternatives occur in both the construction and operation phases. Land use, geology/seismicity, water quality/hydrology, traffic, noise, air quality and odors, vegetation and wild life, visual socio-economical, historical/cultural, community services, and community concerns, will be affected in varying degrees, both positively and negatively. The impact of construction and operation of the three alternatives with regard to environmental factors is discussed in the following summary based on findings presented in the negative declaration prepared by Officer of Environmental Review, Dept. of City Planning, unless otherwise noted.

### **Land Use**

The Lake Merced Transport project would result in no permanent impacts to land uses along the construction corridor. No above-surface structures would be located along the project route following construction and potential operational impacts such as nuisance odors are expected to be minimal or nonexistent (see Air Quality/Climate). The existing Lake Merced Pump Station would ultimately be dismantled and removed to grade. Underground structures would be located largely within City-owned roadway right-of-way property and should therefore not impede future public or private construction projects. Recreational facilities such as the golf course, boathouse, gun club, and fishing areas will not be impacted, nor would access to any of those areas be disrupted. No long range impacts to land use would occur.

## **Geology/Topography**

This section is based on the results of geotechnical investigations carried out along the proposed Lake Merced Transport alignment between 1981 and 1987. There are no known active or potentially active faults in the project area. The maximum probable magnitude of a future earthquake (San Andreas Fault, 1.8 miles to the west) would be 8.3 Richter Magnitude) based on a 50-year project lifetime projection. The resultant ground shaking during a seismic event would be "violent" in the project area. The local geology consists of the Merced Formation, between Lake Merced and the ocean, which is overlain by the Colma Formation and sand dune deposits. Many parts of the roadways along the project route are built upon sandy fill.

Impacts which could occur during or after construction focus on the fine to medium surface sands of the Colma Formation, the loose fine dune sand and the artificial unengineered fill. The native soils of the Colma Formation are weathered and weakly consolidated at the surface. Native dune sand and artificial unengineered fill are even less consolidated than the weathered Colma Formation. Each of these deposits is subject to densification, liquefaction, or landsliding to varying degrees if disturbed.

Liquefaction of dense to very dense sands underlying the proposed structures is also considered unlikely because of the stability of the underlying material. An earthquake induced slide should not affect any of the proposed structures as they are located 45 feet or more from the lake. However, all structures near the lake would be designed to maintain stability under conditions where much of the shoreline slope material has been removed by a landslide into the lake.

In summary, there would be no significant geological impacts from the project. Mitigation measures would reduce or eliminate potential impacts that could arise from worst-case situations.

## **Water Quality**

The proposed project would contribute to achieving the objective of reducing the number of combined sewer overflows to nearshore ocean waters. Therefore adverse impacts on ocean water quality are not expected to occur as a result of either project construction or operation. The project would contribute to improved ocean water quality.

Without mitigation, Lake Merced could experience minor water quality impacts during the project construction period due to erosion of exposed soils at staging areas, generation of litter, and vehicle emissions (hydrocarbons, heavy metals). Standard erosion control and site housekeeping measures would be implemented during the 6-month construction period at the south end to ensure that contamination of Lake Merced does not occur. Neither the shoreline of Lake Merced nor the ocean are expected to be noticeably disturbed. Catch basins will prevent any runoff from the work site from reaching the lake.

As a mitigation measure, natural groundwater flows would be maintained following project completion. Since almost all of the groundwater flow around Lake Merced is to the west, LMT construction would not interrupt aquifer flow to the lake. Subdrains would be constructed, where necessary, beneath or above proposed structures to facilitate the natural seaward flow of groundwater. Similar measures to maintain flows would be incorporated into the project design should underground springs feeding Lake Merced be encountered during construction at the south end of the project alignment. Drains associated with this project would partially alleviate flooding in the Lake Merced area by allowing surface runoff to flow west.

#### **Traffic**

Physical conditions and traffic controls would remain unchanged. Construction traffic would be routed on John Daly Boulevard, Skyline Boulevard (south of the Great Highway extension), and the Great Highway. Traffic entering the John Muir Drive location would use Skyline and depart on John Muir Drive and Lake Merced Boulevard to John Daly Boulevard.

Construction on both the Lake Merced Transport and the Oceanside Plant projects would be scheduled at the same time with an overlap of construction traffic. The traffic analysis indicates that the combined effects of the construction traffic from both projects would result in no significant impacts on road segments in the project vicinity. The project Level of Service would change only slightly and would return to improved levels following completion of project construction. No traffic impact would occur during project operation.

## **Noise**

Existing thoroughfare noise levels along the Great Highway and Skyline Boulevard have been characterized at about 75 Ldn. Background noise levels in the areas are approximately 55 Ldn. Published noise data are not available for John Muir Drive along the project alignment. Potential sensitive receptors in the project area include the Oakwood Apartments on John Muir Drive, the La Playa Apartments at the end of Wawona Street, the San Francisco Zoo east of the Fleishhacker Pool site, residences along Skyline Boulevard near Sloat Boulevard, the Recreation Center for Handicapped Adults east of the proposed Oceanside Plant site, and wildlife and recreational uses along the shoreline of Lake Merced.

The San Francisco Clean Water Program has established criteria for construction noise control for all Clean Water Program contracts. The CWP will assure contractor compliance with these criteria and/or with noise regulations specified in Article 29 of the San Francisco Police Code, whichever results in lower sound levels. According to this Code, the maximum noise level permissible during daytime construction is a steady state level of 80 dBA when measured 100 feet from noise-generating powered construction equipment. Higher levels of impact or intermittent noise are permissible, but all impact tools and equipment must have intake and exhaust mufflers recommended by the manufacturer and approved by the Director of Public Works as best accomplishing maximum noise attenuation.

It is anticipated that major construction noise impacts would be avoided along the proposed project route. Construction traffic would be restricted, which should minimize use of Skyline Boulevard nor the of the intersection with the Great Highway, thereby minimizing noise impacts to the Recreation Center and residences on Skyline Boulevard. Mitigation measures specify truck haul route restrictions. With implementation of noise control measures, noise generated at the excavation sites would be within noise criteria.

## **Air Quality/Climate**

During project construction, short-term air quality impacts could occur due to exhaust fumes from construction equipment, dust from excavation and traffic on unpaved surfaces, and wind erosion of exposed surfaces. Vehicle and equipment operation are not expected to violate ambient air quality standards for emission gases because of the relatively small size of the construction operation and because strong prevailing ocean winds are common in the area.

However, because of these strong winds along the ocean front portion of the Great Highway, dust generation and localized wind erosion of excavated materials could occur. This problem would be exacerbated by the proposed concurrent construction of the Oceanside Plant. Strict dust generation and soil erosion control mitigation measures would be part of the contractual obligation of the construction contractor to reduce the extent of these impacts and ensure that the State 24-hour particulate standard is not exceeded.

Odor levels for the proposed project operations are not expected to exceed thresholds of detectability and therefore would not be considered potentially significant. Vegetation and Wildlife  
Mature trees and natural plant areas would be removed for alternatives LM 1 & 2, but not for alternative LM-3, gravity tunnel.

#### **Vegetation and Wildlife**

Mature trees and natural plant areas would be removed for Alternatives LM 1 and 2, but not for LM-3 gravity tunnel.

Although it is highly unlikely that the project would cause impacts to breeding birds at Lake Merced, construction at the south end, near the Lake Merced Pump Station, would be scheduled between August and February, if possible, to avoid coincidence with the breeding season.

No impacts on vegetation or wildlife are likely to occur following completion of tunnel project construction. The underground transport structure would not result in displacement of vegetation or present additional disturbance to existing habitats.

#### **Socioeconomics**

Construction of any of the alternatives would generate an estimated 40 to 60 jobs over a two year period. Operation of the Lake Merced Transport facility is not expected to generate adverse socioeconomic impacts.

Construction activity equipment and materials, and stockpiled spoils from any alternative would be visible at staging areas.

The Lake Merced Transport project corridor represents a relatively important visual resource within urban San Francisco. The southern portion of the route, along John Muir Drive, offers views of Lake Merced and generally has an attractive tree-lined roadside except at the site of the Oakwood Apartments.

## **Visual**

No permanent visual impacts are expected to occur following construction of Alt. LM-3, gravity tunnel. No above-surface structures would be constructed, nor are new surface lighting systems proposed. The existing Lake Merced Pump Station would ultimately be dismantled and removed from its location adjacent to John Muir Drive.

However, LM-1 AND LM-2 require increasing the size, including the height and bulk of the existing Lake Merced Pump Station.

## **Historical and Cultural**

There are no known sites which may be affected by any of the alternatives, although archeological materials may be encountered during construction. If archeological materials are encountered during construction, a qualified archaeologist should be consulted to determine the significance of the find.

## **Community Concerns**

1. Construction activity of any alternative may reduce emergency vehicle access and response time. Relocation of utilities could be required, particularly along the basin alternatives alignment.

Mitigation measures recommended are: all existing sewer, water, gas, electrical and other utility lines should be identified prior to construction. Police and fire departments should be informed of physical barriers along the alignment so alternate routes may be followed, if necessary, to reduce impacts on response time.

2. Traffic Congestion.

Mitigation measures include restrictions on truck traffic and off-site parking for construction workers.

3. Construction noise will require compliance with CWP noise criteria.
4. Bird breeding season impacts would be mitigated by construction scheduling if possible.

## ADDITIONAL CONSIDERATIONS

Several factors have been included in the foregoing analysis of project alternatives but have not been separately discussed. These factors involve analyses of the use of scarce resources, flexibility and reliability, bypass conditions, flood protection provisions, compatibility with local planning and land use and ability to implement. A general discussion of these factors follows. Their estimated weighting on specific alternatives will be presented in Chapter 8.

### Analysis of Scarce Resources

The two significant scarce resources considered in the analysis of the Lake Merced Transport project are energy and marine resources. Each alternative was evaluated for its effect on these resources.

#### 1. Energy

Comparison of energy consumption for a tunnel alternative versus a force main and storage structure alternative is shown below.

#### COMPARISON OF ENERGY CONSUMPTION

| ITEM   | TUNNEL (x10) <sup>6</sup> | FORCE MAIN<br>& STORAGE (x10) <sup>6</sup> |
|--|---------------------------|--|
| 1. Construction Energy Usage (kw-HR)*                            | 0.9                       | 0.84                                       |
| 2. Annual Operating Energy Consumption**                         |                           |  |
| Wet Weather (kw-HR)  | 0.167                     | 0.333                                      |
| Dry Weather (kw-HR)  | 0                         | 0.212                                      |
| Total (kw-HR)  | 0.167                     | 0.545                                      |
| 3. Total Energy Consumption over 20 year planning period (kw-HR) | 3.34                      | 10.9                                       |

\*Construction energy includes the excavation, transportation of haul material for 20 mile round trip, and miscellaneous equipment (as calculated by EIP).

\*\*Annual operating energy indicates the energy required to pump via force main vs. conveyance by gravity flow into WST and prorated pumping to SWWPCP (as calculated by CWP). Pump efficiency of 75% is assumed.

## **2. Marine Resources**

The marine resources of San Francisco Bay must also be considered a scarce resource; development of any of the three alternatives will have a substantial impact on marine resources. These resources have deteriorated greatly in the last 100 years, probably in large part due to the discharge of pollutant materials. Each of the proposed alternatives would have positive impacts on improvement of water quality along San Francisco beaches. The once thriving shellfish industry and still prosperous commercial and sport fishing industries could potentially be enhanced by improvement of water quality. A side benefit of improved marine resources is the increased recreational opportunities along the entire City perimeter.

### **Flexibility and Reliability**

Flexibility and reliability are the major criteria on which projects are evaluated for their ability to meet existing and future changes in technology, water quality requirements and adverse conditions.

1. Flexibility - Flexibility is the ability of the facilities to operate under a wide range of conditions (i.e., delivering flows greater than originally intended to take advantage of certain rainfall conditions to avoid overflows).
2. Reliability - Reliability is the measure of a project's ability to meet performance criteria continuously. It has to do with ensuring that the project functions as intended under various adverse conditions (e.g. power failure, earthquake) and does not adversely affect other projects.

### **BYPASS CONDITIONS**

Bypasses, as distinguished from overflows, occur when the components of the whole CWP system are not used to capacity and direct untreated discharges to the receiving water result. Bypasses refer to water pollution control facilities. In the case of the Lake Merced Transport project, bypass analysis refers to the ranking of the ability of the alternative to hold back or to throttle dry weather flows when the OWPCP may experience a potential bypass condition.



## **FLOOD PROTECTION PROVISIONS**

None of the alternatives need any special flood control works.

## **COMPATIBILITY WITH LOCAL PLANNING AND LAND USE**

All the alternatives are compatible with planning and land use envisioned in the Master Plan.

## **ABILITY TO IMPLEMENT**

The ease with which an alternative could be designed and constructed was assessed under this category. The institutions necessary to implement the plan exist. A San Francisco bond issue was passed to provide part of the financing. Implementability depends upon availability of loan funds from the Federal and State agencies involved.

## **PUBLIC ACCEPTABILITY**

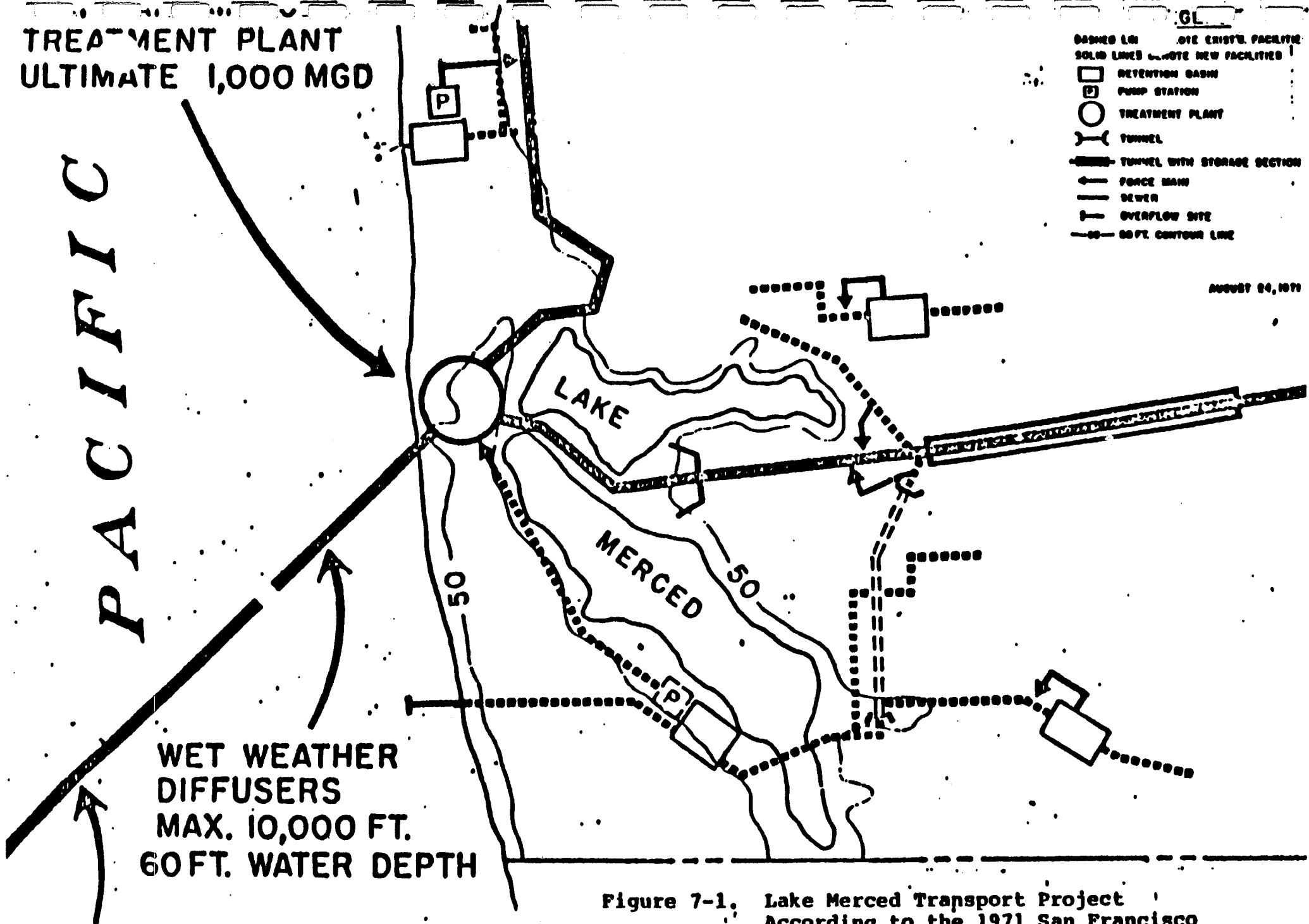
Significantly greater concern was registered by the public with regard to alternatives LM-1 and LM-2. This was due to the greater impacts to vegetation (loss of many trees), to noise (pump station construction adjacent to apartment buildings) and to long-term visual impacts of the pump station.

GL

TREATMENT PLANT  
ULTIMATE 1,000 MGD

- DASHED LINE EXIST'G FACILITIES
- SOLID LINE NEW FACILITIES
- RETENTION BASIN
- PUMP STATION
- TREATMENT PLANT
- TUNNEL
- TUNNEL WITH STORAGE SECTION
- FORCE MAIN
- SEWER
- OVERFLOW SITE
- 50 FT. CONTOUR LINE

AUGUST 24, 1971



WET WEATHER  
DIFFUSERS  
MAX. 10,000 FT.  
60 FT. WATER DEPTH

DRY WEATHER DIFFUSERS  
MAX. 2,000 FT.

Figure 7-1. Lake Merced Transport Project  
According to the 1971 San Francisco  
Master Plan.

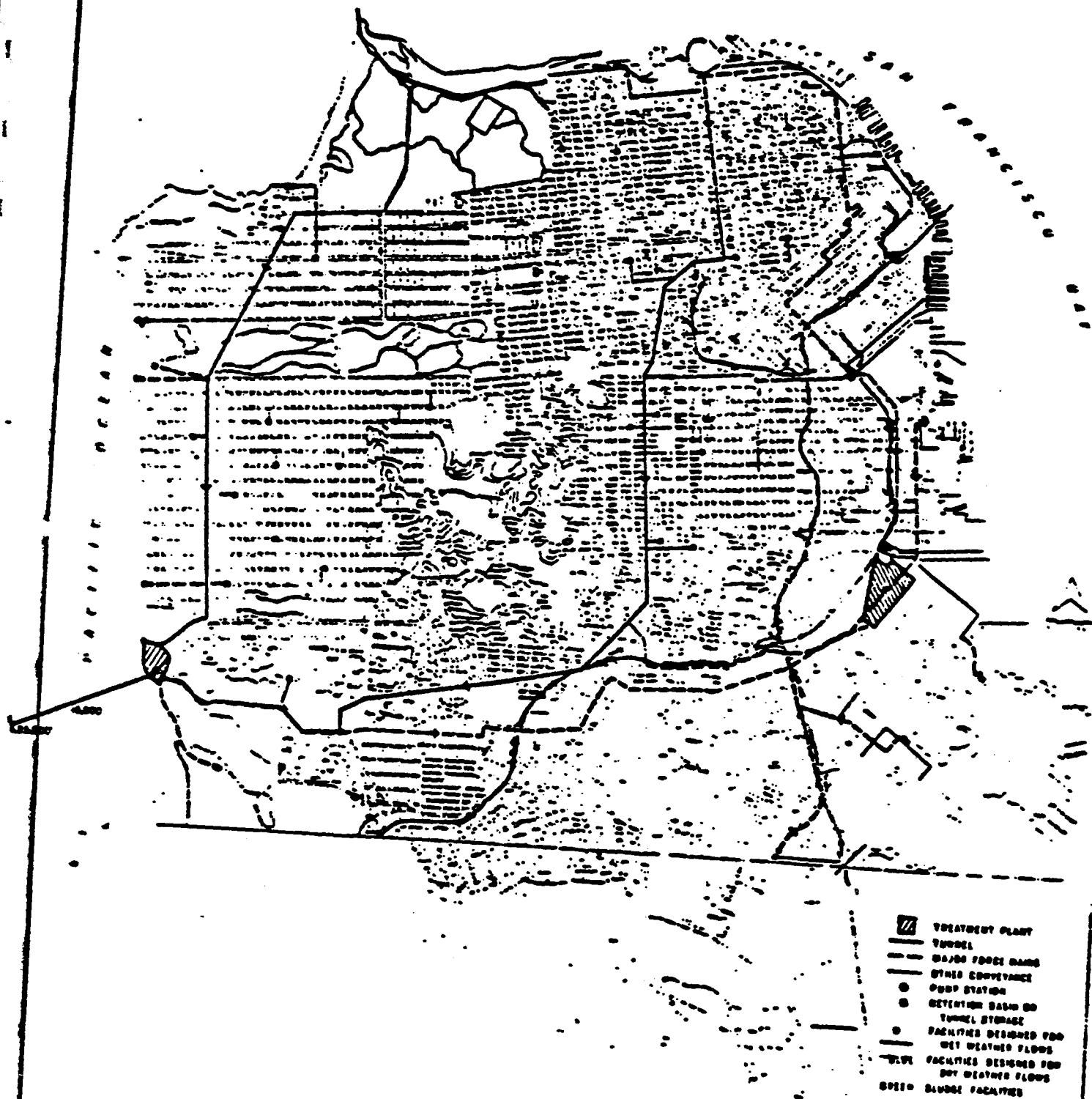
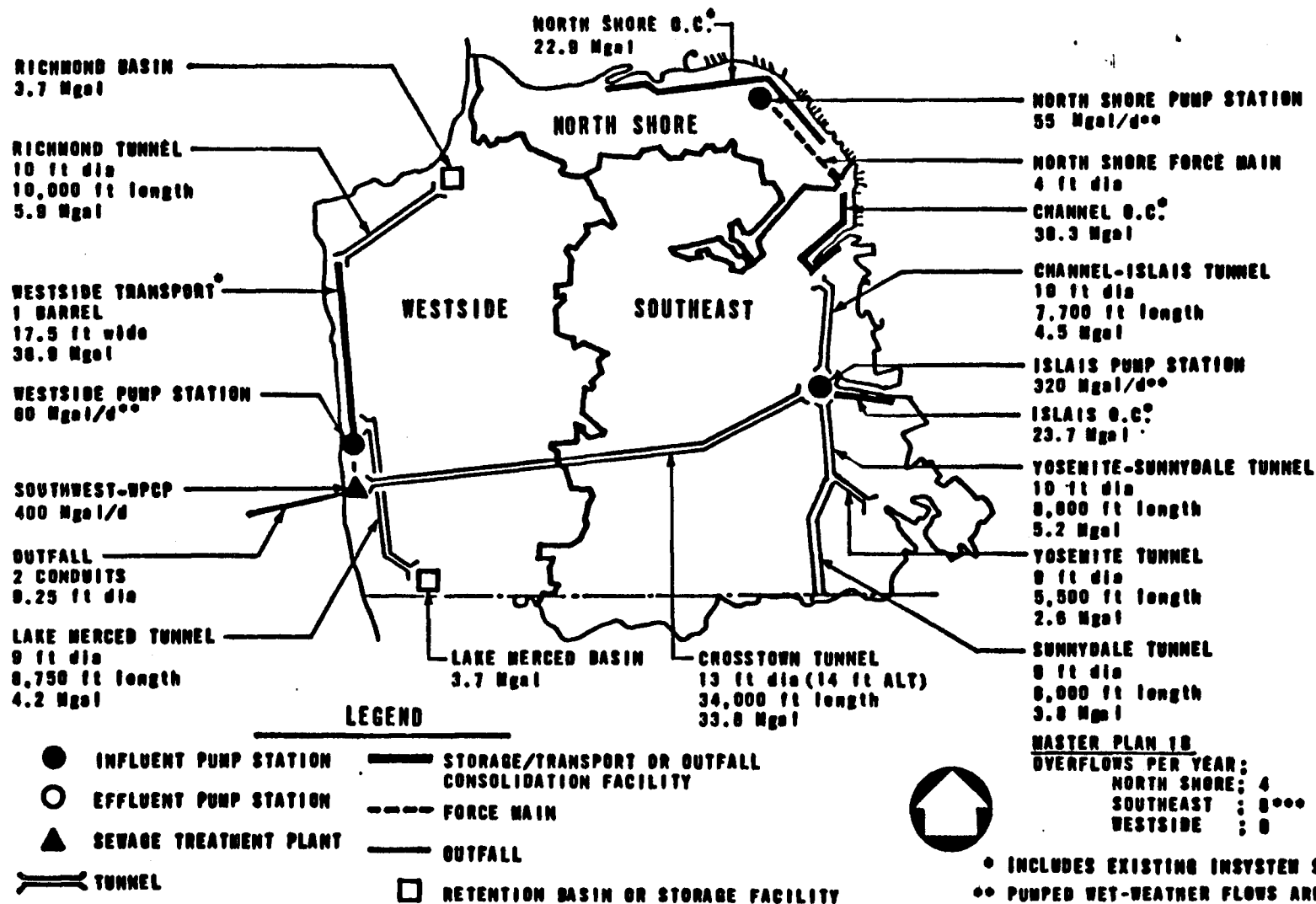


FIGURE 7-2 - RECOMMENDED LONG-RANGE PLAN  
 According to Overview Facilities  
 Plan of 1975.



**FIGURE 7-3 . SCHEMATIC OF APPARENT BEST ALTERNATIVE WET-WEATHER SYSTEM**

Recommended in "Southwest Water Pollution Control Plant Project"  
Final Project Report 1980

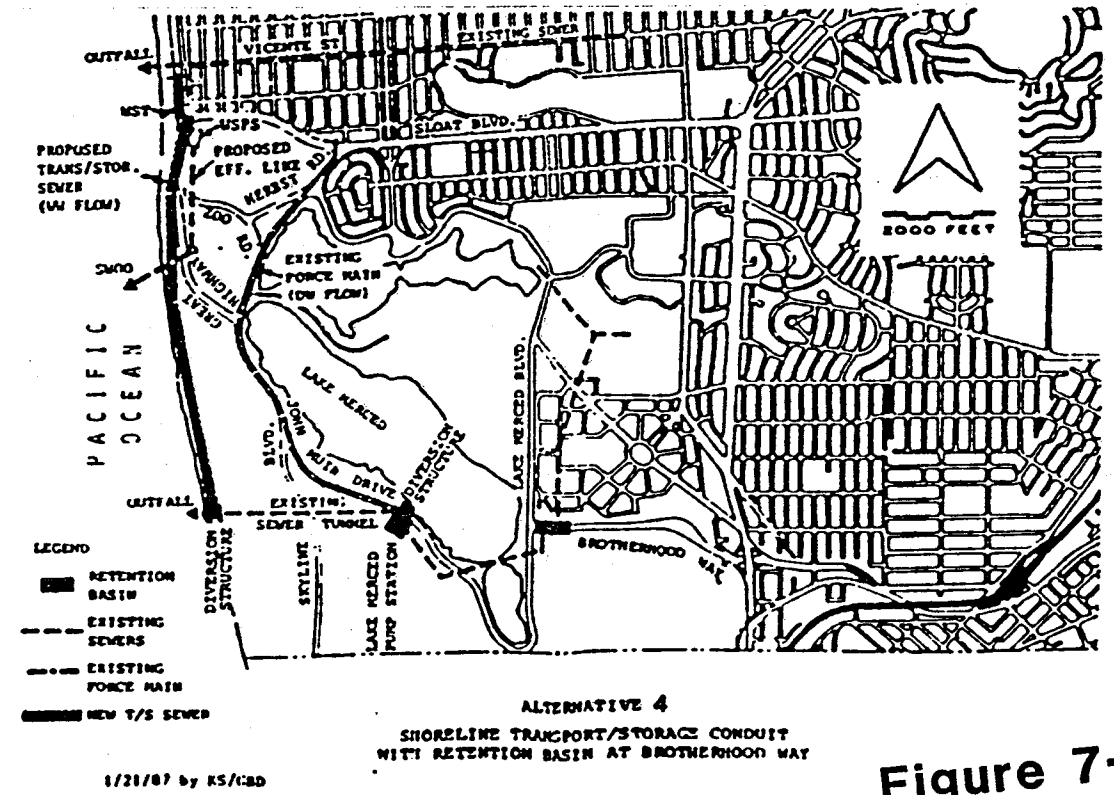
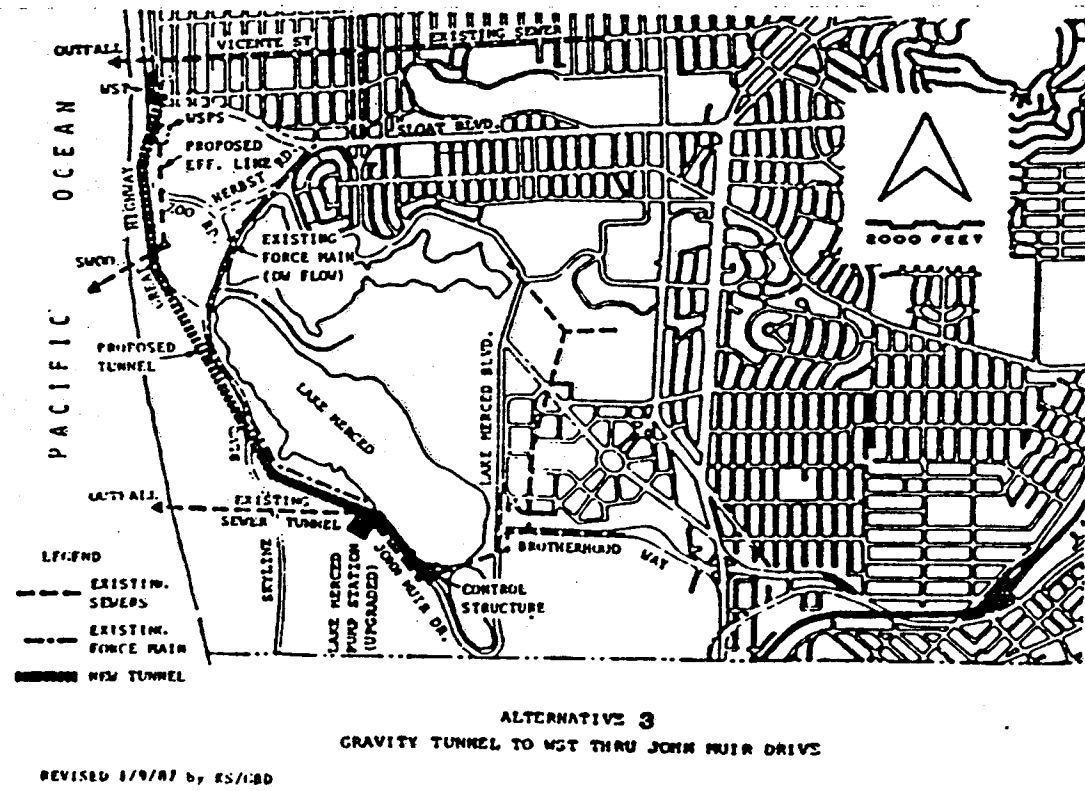
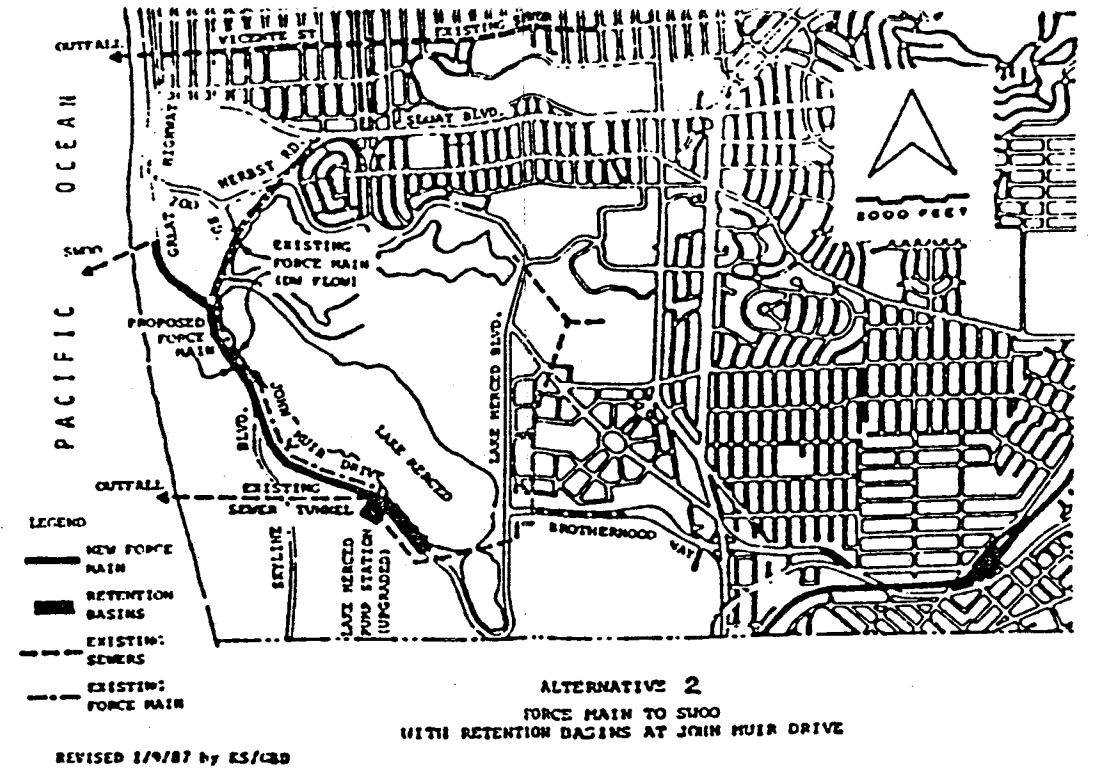
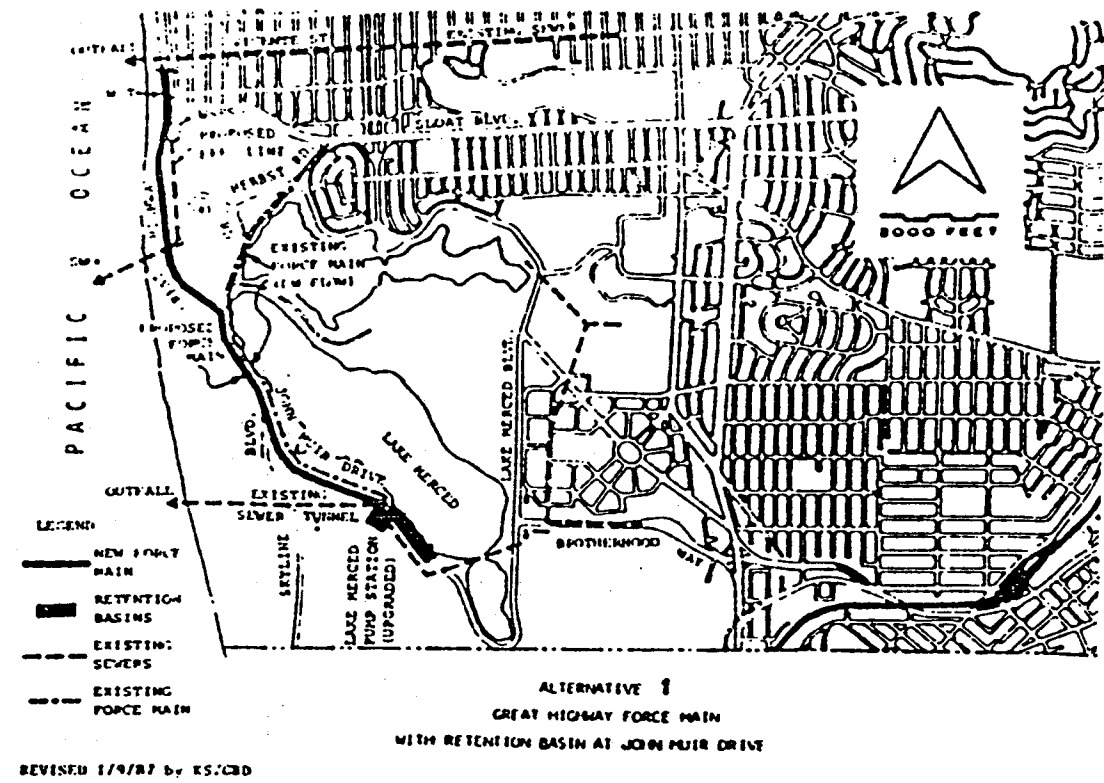
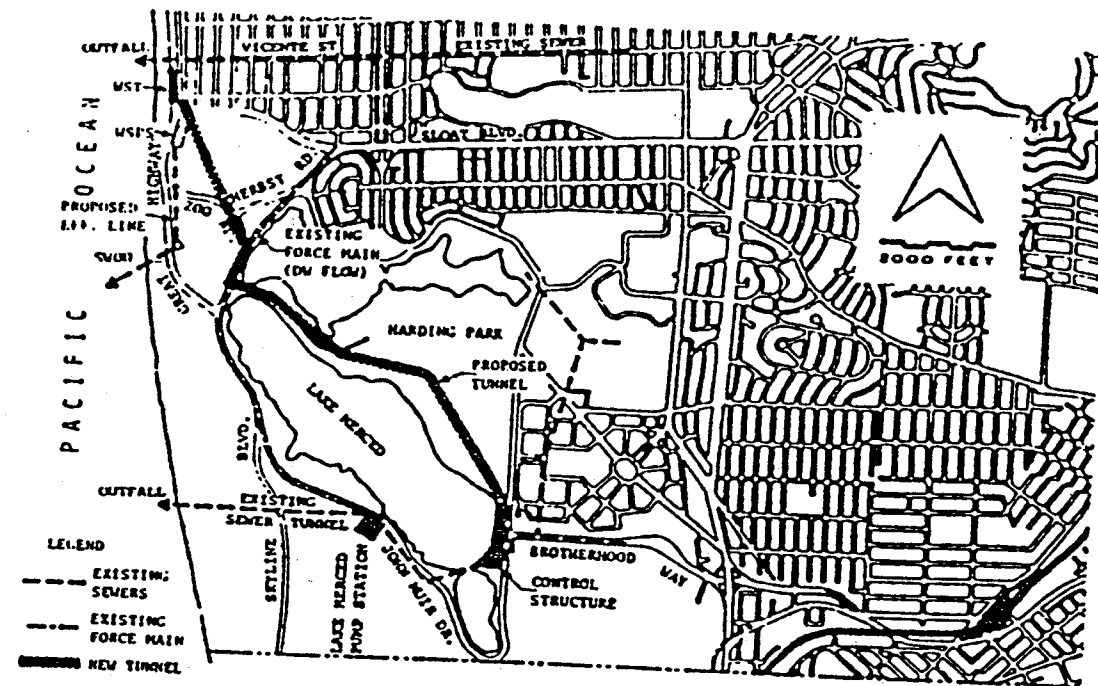
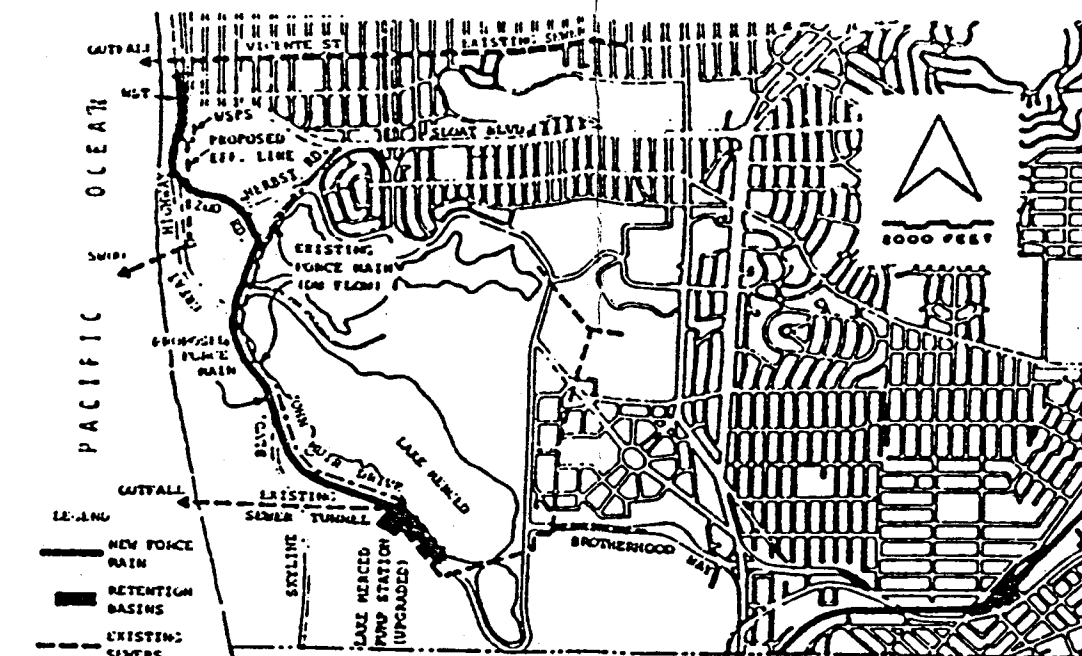


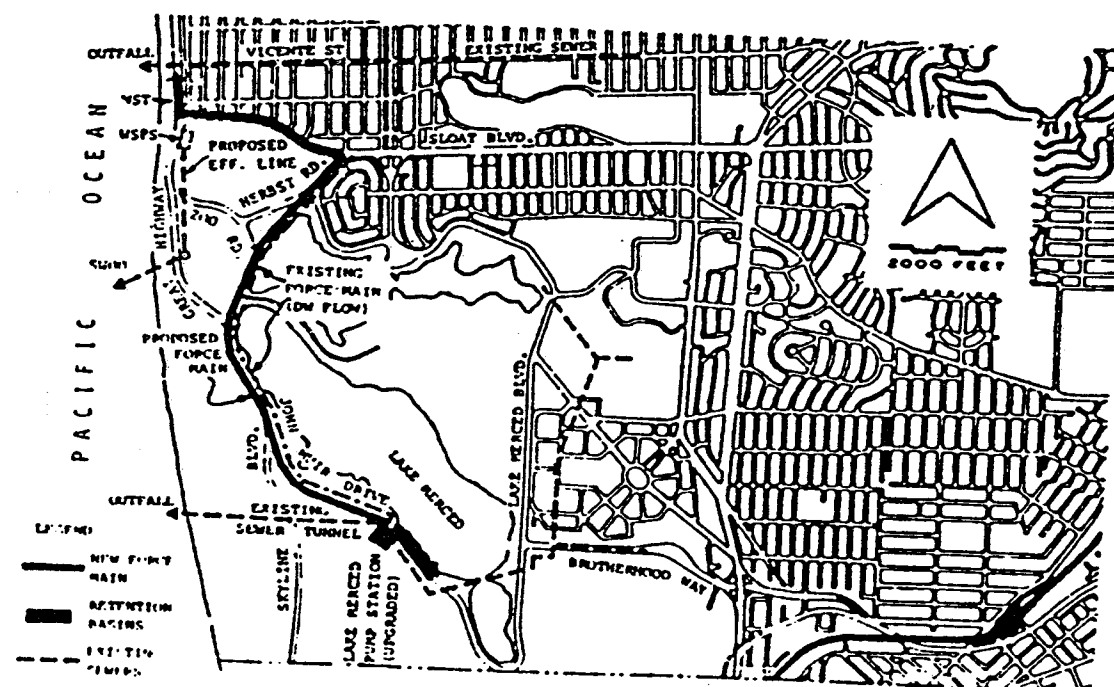
Figure 7-4



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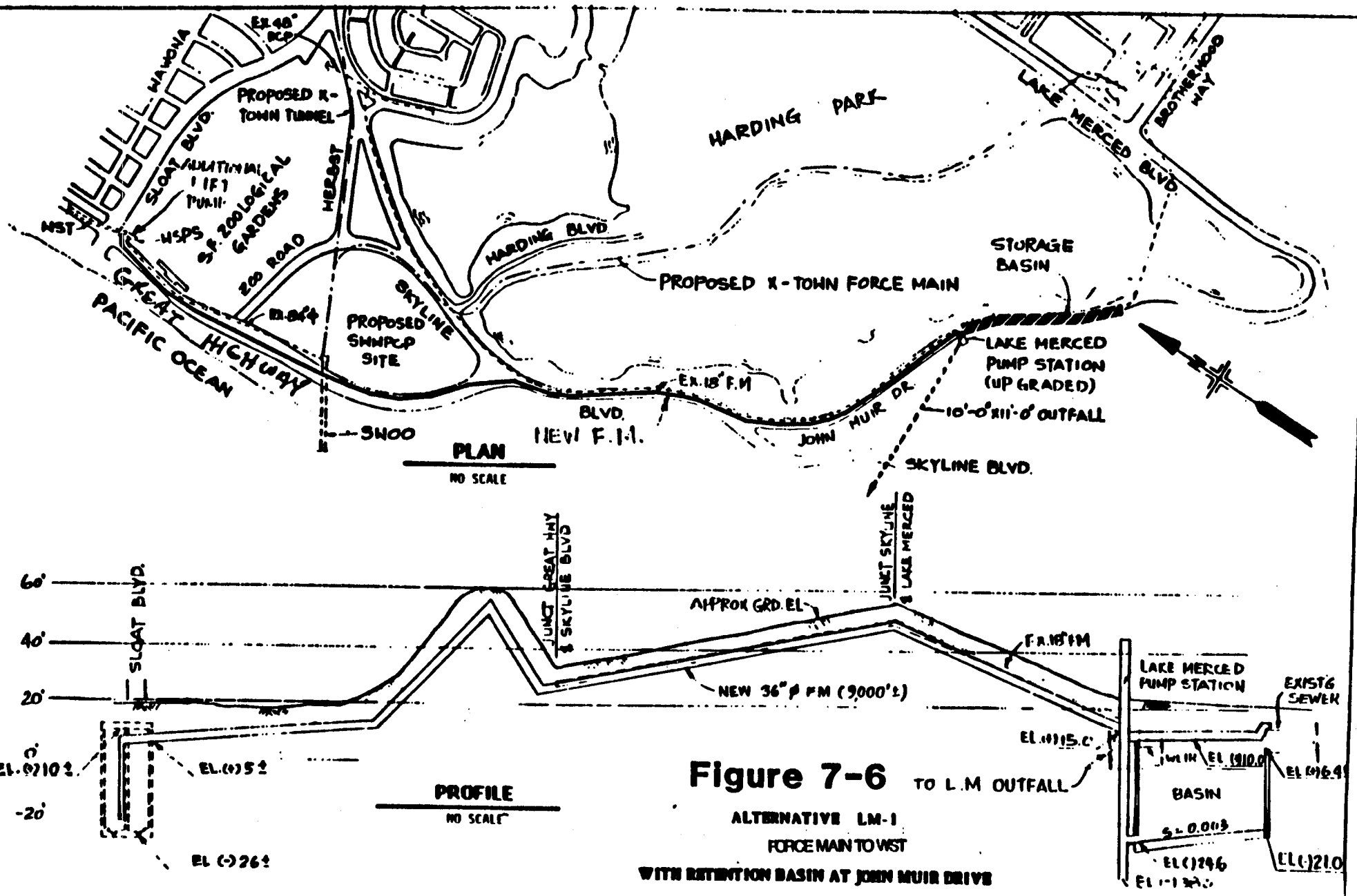
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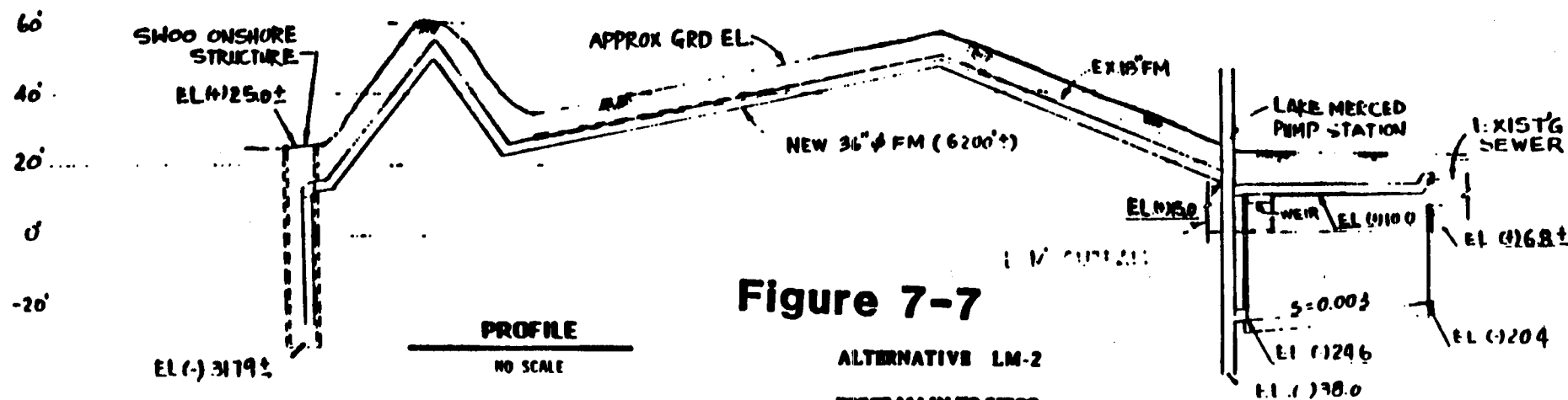
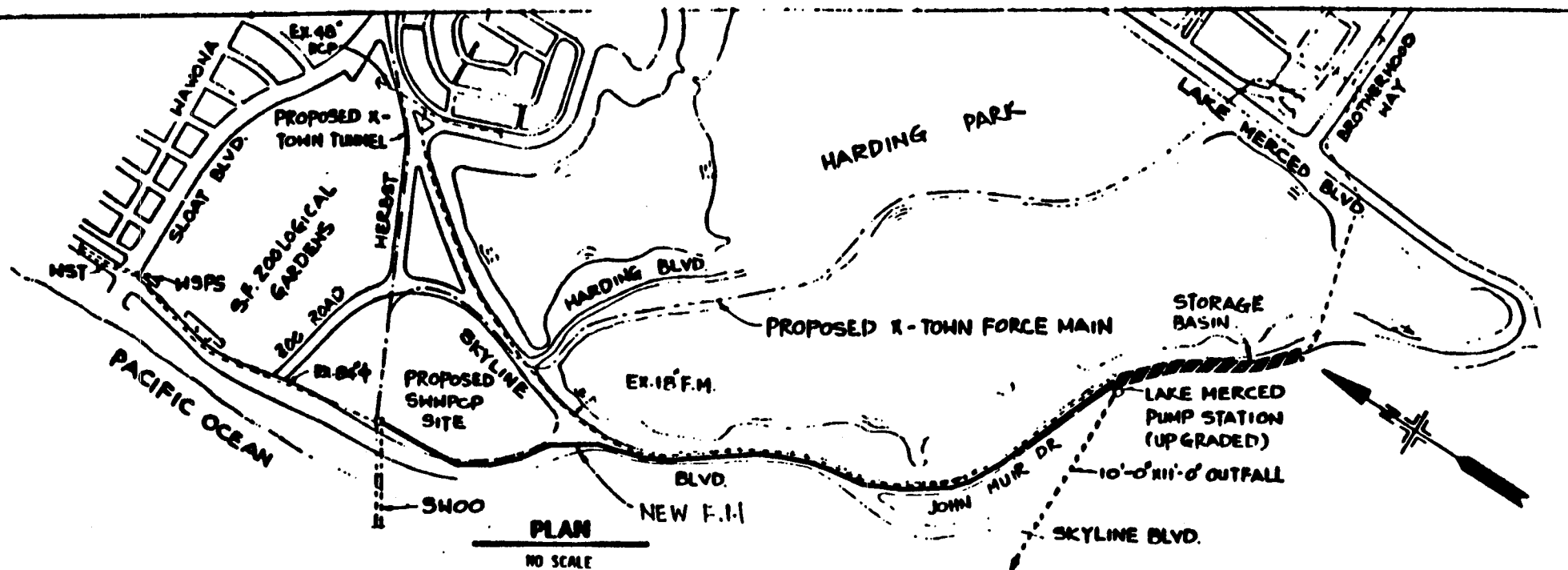


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Figure 7-5

Figure 7-5





**Figure 7-7**

ALTERNATIVE LM-2

FORCE MAIN TO SWOO  
WITH RETENTION BASIN AT JOHN MUIR DRIVE





## **CHAPTER 8**

### **SUMMARY COMPARISON OF PROJECT ALTERNATIVES**

#### **INTRODUCTION**

This Chapter identifies the apparent best alternative from the three viable alternatives considered in Chapter 7. The material in this chapter is advisory in nature and discusses the general considerations that are important in selecting a preferred plan. Consideration should be given to any additional factors that may be appropriate for the project in arriving at a final decision which best reflects the needs and concerns of the whole community, while satisfying the requirements for water quality protection.

The evaluation process involves the following items that assist in the rational selection of the preferred alternative plan:

- o Determination of evaluation factors and the relative weighting of those factors.
- o Discussion of the relative advantages and disadvantages of each alternative and the trade-off considerations resulting in the selection of the apparent best alternative.
- o Comparative ranking of the alternatives with respect to each factor.

To facilitate understanding of the selection process used, the next section provides an overview of the methodology used in comparing the alternatives. This is then followed by the steps required in the selection process.

#### **ALTERNATE COMPARISON METHODOLOGY**

The three alternatives are compared against one another with respect to 14 evaluation factors. The list includes all of the 12 factors required to be considered by the SWRCB guidelines plus two additional factors (equivalent annual costs and water quality impacts). Since the 14 evaluation factors selected are not all equally important, the first step is to assign relative weights to the factors themselves.

In this chapter, the methodology used to weigh the factors and to rank the alternatives is as follows:

1. The 14 evaluation factors are divided into three groups--cost factors, environmental/social factors, and engineering factors as originally developed by Metcalf and Eddy.

2. The factors within each group are assigned relative weights as discussed in the following section.
3. The relative advantages and disadvantages of the alternatives are summarized followed by ranking the 3 alternatives for each group of factors.
4. The alternative(s) ranked the highest in each group are discussed with respect to relative advantages and disadvantages and trade-offs among cost, environmental/social, and engineering aspects.
5. The apparent best alternative is identified from the above discussion and is described, including its advantages and possible disadvantages.

### **WEIGHTING OF EVALUATION FACTORS**

The 14 evaluation factors with their relative weights are shown in Table 8-1. The list of factors is divided into the three general groups of cost, environmental/social, and engineering factors.

The evaluation factors within each group have been weighted with respect to each other factor in that group. No attempt has been made to weight the groups with respect to each other. The relative importance of the evaluation factors is a function of the project planning goals and objectives (Chapter 1) and the degree of impact on citizens, the City and Bay region. The rationale for the weighting within each group is discussed in the following:

### **COST FACTORS**

The four factors related to cost are equivalent annual cost, operation and maintenance cost, capital cost, and ability to implement (implementability). The equivalent annual cost has been weighted the highest because continued public support is essential to the success of the project and this cost represents a bottom-line cost to the user. The operation and maintenance cost factor which represents continually escalating future expenditures that must be totally supported by local funds, has been weighted the same as the capital costs, for which state and federal loan fund support is to be made available on eligible components. Operation and Maintenance and capital costs represent major concerns and are weighted higher than implementability. The ability to implement is a function of both the required inter-agency approvals and the financial aspects of each alternative. Since the other portions of the costs are covered separately, the ability to implement was given the lowest weighting of the cost factors. However, delays in obtaining necessary approvals could have a substantial inflationary impact on project costs.

**TABLE 8-1. WEIGHTING OF EVALUATION**

| <b>FACTOR</b>                     | <b>RELATIVE WEIGHT</b> |
|-----------------------------------|------------------------|
| <b>Cost</b>                       |                        |
| Equivalent Annual                 | 10                     |
| Operation and Maintenance         | 4                      |
| Capital                           | 4                      |
| Implementability                  | 2                      |
| <b>Environmental/Social</b>       |                        |
| Environmental Impact              | 10                     |
| Public Acceptability              | 7                      |
| Social Impact                     | 5                      |
| Compatibility with Local Planning | 2                      |
| Land Use                          | 2                      |
| Scarce Resources                  | 1                      |
| <b>Engineering</b>                |                        |
| Water Quality Impact              | 10                     |
| Reliability                       | 8                      |
| Flexibility                       | 6                      |
| Bypass Analysis                   | 1                      |
| Flood Protection                  | 1                      |

## **Environmental/Social Factors**

The environmental/social factors considered are: environmental impact, public acceptability, social impact, compatibility with local planning, land use, and scarce resources. The environmental impact of a project is weighted the highest because of the environmental sensitivity of the City's location and citizenry. The environmental impacts include traffic and transportation, noise, air quality, visual impacts, vegetation and wildlife, aquatic ecology, and seismicity.

Public acceptability has been ranked next in importance and is a function of cost, the need for water quality improvement, and for control of and reduction of overflows throughout the City. Compatibility with local planning, land use, and social impact were rated equal but of lower importance than the first two factors. Conservation of scarce resources (energy and manufactured materials) was ranked lowest of the environmental/social factors.

## **Engineering Factors**

There are four engineering factors: Water quality impact, flexibility and reliability, bypass analysis and flood protection. The highest weighting is water quality impact, followed by flexibility and reliability because these factors represent the required objectives of the alternative finally selected. The most important engineering factors are water quality impact in terms of reduction in combined sewer overflows and protection of recreational interests. The alternative selected must provide for flexibility in operation considering the intermittent nature of wet-weather flows and must be reliable in terms of having the simplest operational components.

Bypass analysis is ranked third in importance but well below the first two factors. The last factor, flood protection, is considered slightly less important than bypass analysis.

## **ADVANTAGES AND DISADVANTAGES**

To provide a background for the ranking of alternatives, the relative advantages and disadvantages of the alternatives are summarized in the following. Then, the alternatives are ranked with respect to the three groups of factors, i.e., cost, environmental/social, and engineering factors. After identifying the highest ranked alternative from each group, the trade-offs among them are discussed and the apparent best alternative is selected.

The relative advantages and disadvantages of each of the three alternatives are listed in Tables 8-2 through 8-4.

**TABLE 8-2.**  
**RELATIVE ADVANTAGES AND DISADVANTAGES**  
**ALTERNATIVE LM-1**  
**(BASIN WITH FORCE MAIN TO WST)**  
**(Project Cost: \$25M)**

**Advantages:**

1. Lowest capital cost alternative (although differences among the alternatives is marginal at this general level)
2. Controllable flow rate to WST

**Disadvantages:**

1. Cut and cover construction of force main and basin will cause more traffic, access, noise and dust disruption than tunnel alternatives. Mitigating these will add to costs.
2. Water Dept. does not favor the basin location because it is close to emergency water supply (Lake Merced) and leakage may occur. Protecting the basin against leakage would increase costs.
3. Extensive construction will occur near major recreational facilities, diminishing their value for users. Many mature trees would be destroyed.
4. Excessive sewage retention time in basin may cause odor problems under certain temperature and wind conditions, based on experience.
5. Increases size of a utilitarian structure, the pump station, in a largely scenic recreation area. Mitigating these impacts through undergrounding or additional features would increase costs.
6. Excavation will deteriorate the entire asphalt pavement of John Muir Drive, based on experience in most other CWP projects.
7. Uses more scarce energy resources.
8. Higher maintenance costs than gravity alternative (LM-3).
9. Does not reduce the risk of flooding due to existing sewer inadequacies.

**TABLE 8-3. RELATIVE ADVANTAGES AND  
DISADVANTAGES ALTERNATIVE LM-2  
(BASIN WITH FORCE MAIN TO SWOO)  
(Project Cost: \$26M)**

**Advantages:**

1. Least disruptive to Great Highway.
2. Controllable flow rate to SWOO.

**Disadvantages:**

1. Highest maintenance cost of all 3 alternatives.
2. Water Dept. does not favor the basin location because it is close to emergency water supply (Lake Merced) and leakage may occur. Protecting the basin against leakage would increase costs.
3. Extensive construction will occur near major recreational facilities, diminishing their value for users. Many mature trees would be lost.
4. Excessive sewage retention time in basin may cause odor problems under certain temperature and wind conditions, based on experience.
5. Increases size of a utilitarian structure, the pump station, in a largely scenic recreation area. Mitigating these impacts through undergrounding or additional features would increase costs.
6. Excavation will deteriorate the entire asphalt pavement of John Muir Drive, based on experience in most other CWP projects.
7. Uses more scarce energy resources.
8. Cut and cover construction of force main and basin will cause more traffic, access, noise and dust disruption than LM-1 and LM-3 alternatives. Mitigating these will add to costs.
9. Does not reduce the risk of flooding due to existing sewer inadequacies.

**TABLE 8-4. RELATIVE ADVANTAGES AND  
DISADVANTAGES ALTERNATIVE  
LM-3 (TUNNEL TO WST)  
(Project Cost: \$29M)**

**Advantages:**

1. Low maintenance alternative.
2. Favored alternative of the Coastal Commission and Rec./Park Department because it is least disruptive to Rec Center for the Handicapped, to the many recreational facilities and to vegetation, including mature trees.
3. Least adverse citizen impact of any of the 3 alternatives.
4. Least disruptive to residences near existing pump station. A shorter construction period would be required to remove the pump station, compared with expansion of existing pump station.
5. Eliminates existing pump station, removing a utilitarian structure from a scenic recreation area. Cost of mitigation features could be great.
6. Substantial reduction of risk of flooding due to existing sewer inadequacy.

**Disadvantages:**

1. Most expensive alternative to construct.

**RANKING OF ALTERNATIVES**

**A. COST RANKING**

The ranking of alternatives with respect to cost factors is shown in Table 8-5. The ranking rationale is described for each factor.



**TABLE 8-5.  
RANKING OF ALTERNATIVES  
COST FACTORS**

| FACTOR                       | RELATIVE<br>WEIGHT (RW) | RATING (R) |      |      | RWxR      |           |           |
|------------------------------|-------------------------|------------|------|------|-----------|-----------|-----------|
|                              |                         | LM-1       | LM-2 | LM-3 | LM-1      | LM-2      | LM-3      |
| Equivalent Annual<br>Cost    | 10                      | 3.1        | 3.0  | 2.9  | 31        | 30        | 29        |
| Operation and<br>Maint. Cost | 4                       | 1          | 1    | 2    | 4         | 4         | 8         |
| Capital Cost                 | 4                       | 3.1        | 2.8  | 2.7  | 12        | 11        | 11        |
| <b>TOTAL</b>                 |                         |            |      |      | <b>47</b> | <b>45</b> | <b>48</b> |

Note: Table of numerical values: Highest number represents highest rating.

**DEFINITION OF FACTORS:**

**Equivalent Annual.**

The equivalent annual cost is the cost that the taxpayer will have to pay. This represents the operation and maintenance cost for the system, in addition to the capital recovery cost for construction of the facilities. The alternative with the lowest equivalent annual cost was rated best.

**Operation and Maintenance Cost.**

The projected annual operation and maintenance cost, when all of the facilities required for each individual alternative are completed and in operation, form the basis for this evaluation criteria. These costs include manpower, energy, repairs of equipment, and an allowance for inflation. The alternative with the lowest operation and maintenance cost received the highest ranking.

**Capital Cost.**

The alternatives were ranked on the basis of the present worth of the project costs as identified in the Monetary Cost section of Chapter 7. The capital cost includes both the City's share and the state and federal grant shares. The least costly alternative received the highest ranking.

## B. ENVIRONMENTAL/SOCIAL RANKING

The ranking of alternatives with respect to environmental/social factors is shown in Table 8-6 and the rationale is described in the following:

**TABLE 8-6. RANKING OF ALTERNATIVES  
ENVIRONMENTAL/SOCIAL FACTORS**

| FACTOR               | RELATIVE<br>WEIGHT (RW) | RATING (R) |      |      | RWxR |      |      |
|----------------------|-------------------------|------------|------|------|------|------|------|
|                      |                         | LM-1       | LM-2 | LM-3 | LM-1 | LM-2 | LM-3 |
| Environmental        |                         |            |      |      |      |      |      |
| Impacts              | 10                      | 2          | 1    | 3    | 20   | 10   | 30   |
| Public Acceptability | 8                       | 2          | 1    | 3    | 16   | 8    | 24   |
| Implementability     | 6                       | 2          | 2    | 3    | 12   | 12   | 18   |
| Social Impact        | 5                       | 1          | 1    | 2    | 5    | 5    | 10   |
| Scarce Resources     | 2                       | 1          | 1    | 2    | 2    | 2    | 4    |
| Compatibility with   |                         |            |      |      |      |      |      |
| Local Planning       | 1                       | 3          | 3    | 3    | 3    | 3    | 3    |
| Land Use             | 1                       | 3          | 3    | 3    | 3    | 3    | 3    |
| TOTAL                |                         |            |      |      | 61   | 43   | 92   |

Note: Numerical Values: Highest number represents highest rating.

### DEFINITION OF FACTORS:

#### Environmental Impacts.

The environmental analysis of each alternative is documented in the environmental assessment reports (8-4). Of specific concern in evaluating this factor as part of the summary comparison are the following: visual aspects, vegetation, wildlife, and aquatic ecology, traffic and transportation, noise, air quality, geology/soils/seismicity, community services, and community characteristics and attitudes. Other categories that are identified in the environmental assessment are covered under several of the other factor headings in this report. The alternative that least disrupts the environment was rated best.

#### Public Acceptability.

This factor reflects the acceptability of each alternative to those persons affected by the plan, their elected representatives, and the goals of the community. Based on information gathered at public meetings held to date the alternative having the greatest anticipated public acceptance was given the best rating.

#### **Implementability.**

The ease with which an alternative could be designed and constructed was assessed under this category. The institutions necessary to implement in the plan exist. Implementability depends upon release of necessary funds from the Federal and State agencies involved.

#### **Social Impact Analysis.**

The social impact factors concern the disruption of normal living patterns by the construction and operation of new or modified facilities. The alternative having the least social impact was given the best rating for this factor.

#### **Scarce Resource Analysis.**

Each alternative was evaluated for its effect on the impact on scarce resources which included electrical power and marine resources. The alternative having the least effect on scarce resources was given the best rating.

#### **Land Use Analysis.**

The compatibility of each alternative with the City and County of San Francisco's land use plan was evaluated. The alternative most compatible with the land use plan was given the best ranking.

#### **Rating Considerations and Conclusions.**

Environmental/Social factors do not lend themselves to quantitative ratings and so ranking the alternatives with respect to these factors is more qualitative.

#### **C. ENGINEERING RANKING.**

The alternatives ranking with respect to engineering factors is shown in Table 8- 7. The rationale for ranking is discussed for each factor in the following:

**TABLE 8-7.  
RANKING OF ALTERNATIVES  
ENGINEERING FACTORS**

| FACTOR          | RELATIVE<br>WEIGHT (RW) | RATING (R) |      |      | RWxR      |           |           |
|-----------------|-------------------------|------------|------|------|-----------|-----------|-----------|
|                 |                         | LM-1       | LM-2 | LM-3 | LM-1      | LM-2      | LM-3      |
| Water Quality   |                         |            |      |      |           |           |           |
| Impact          | 10                      | 2.5        | 2.5  | 3    | 25        | 25        | 30        |
| Reliability     | 8                       | 2          | 1    | 3    | 16        | 8         | 24        |
| Flexibility     | 6                       | 3          | 2    | 1    | 18        | 12        | 6         |
| Bypass Analysis | 3                       | 2          | 2    | 3    | 6         | 6         | 9         |
| Flood Analysis  | 1                       | 1          | 1    | 3    | 1         | 1         | 3         |
| <b>TOTAL</b>    |                         |            |      |      | <b>66</b> | <b>52</b> | <b>72</b> |

**Note:** Table of numerical values: Highest number represents highest rating.

**DEFINITION OF FACTORS:**

**Water Quality Impacts.**

This factor deals with the ability of each alternative to meet or exceed the discharge and receiving water criteria established by the State and Federal regulatory agencies. The ability to meet the goals established by the basin plan and to reduce the number of receiving water coliform violation days resulting from combined sewer overflows are also included in this factor. The alternative that best meets or exceeds the discharge requirement cited in Chapter 6 was given the best rating.

**Reliability.**

In this category, the alternative that was the most reliable was given the best ranking. Reliability has to do with ensuring that the project functions as intended under various adverse conditions (e.g., power failure, earthquake and does not adversely affect other projects).

**Flexibility.**

Is the ability of the facilities to operate under a wide range of conditions (i.e., delivering flows greater than originally intended to take, advantage of certain rainfall conditions to avoid overflows). While flexibility is important, reliability is of greater importance in meeting overflow frequency criteria.

## **Bypass Analysis**

Bypasses, as distinguished from overflows, occur when the system components are not used to capacity and direct untreated discharges to the receiving water result. Bypasses refer to water pollution control facilities, but in the case of the Lake Merced Transport project bypass analysis refers to the ranking of the ability of the alternative to contain dry-weather flows to the treatment plant when it may experience a potential bypass condition.

## **Flood Protection Analysis.**

Special flood control work is not necessary. However, LM-3 will help alleviate local and upstream flooding. Alternative LM-1 and LM-2 were rated equal in exposure to flooding hazards.

### **SUMMARY AND CONCLUSIONS SELECTION OF APPARENT BEST ALTERNATIVE**

The selection of the apparent best alternative is ultimately based on the relative ranking of the alternatives, relative advantages and disadvantages, and the trade-offs between the various evaluation factors. This selection process is partly judgmental because not every advantage or disadvantage lends itself to quantitative characterization. This is apparent in the ranking process shown earlier for each group of factors and carries over into the selection of the best plan in this section.

A summary of the evaluation factor group rankings is shown in Table 8-8. This summary is provided for comparison only since no relative weights are assigned to the individual factor groups.

**TABLE 8-8.  
SUMMARY OF EVALUATION  
FACTOR GROUP RANKINGS**

| <b>EVALUATION FACTOR GROUP</b> | <b>ALTERNATIVE RANKING</b> |             |                  |
|--------------------------------|----------------------------|-------------|------------------|
|                                | <b>LM-1</b>                | <b>LM-2</b> | <b>LM-3</b>      |
| <b>Cost</b>                    | <b>47</b>                  | <b>45</b>   | <b>48</b>        |
| <b>Environmental/Social</b>    | <b>61</b>                  | <b>43</b>   | <b>92</b>        |
| <b>Engineering</b>             | <b>66</b>                  | <b>52</b>   | <b>72</b>        |
| <b>TOTAL</b>                   | <b>174</b>                 | <b>140</b>  | <b>212 = ABA</b> |

**Note: Highest amount is best.**

## CHAPTER 9 APPARENT BEST ALTERNATIVE PROJECT

### INTRODUCTION

This chapter presents the Apparent Best Alternative (ABA) for the Lake Merced Transport service area as described in terms of system concept, design criteria, costs, performance, operation and financial management. LM-3, the gravity tunnel to the Westside Transport through John Muir Drive has been determined the Apparent Best Alternative.

### PROJECT DESCRIPTION

#### Alternative LM-3: Gravity Tunnel to Westside Transport

Under this Alternative, Lake Merced wet weather flows would be routed to the Westside Transport (WST) box via a large diameter gravity tunnel, thereby eliminating the need for a storage basin, expanded Lake Merced Pump Station and force main (see Figures 9-1 to 9-3). The tunnel, which would be constructed underground by conventional tunneling methods would be approximately 13.5 feet in diameter and 8,600 feet long with a storage capacity of 9.5 mg. The alignment follows the road easement, which is up to 60 feet wide. The only surface structures along the alignment are a series of apartments along John Muir Drive near the southern terminus.

A diversion control structure with weir length of 200'+/- would be constructed along John Muir Drive near the existing pump station and using the access shaft as part of structure. This will divert flows exceeding the capacity of the tunnel into the existing Lake Merced Outfall.

As part of this alternative, an additional pump of 20+/- mgd capacity would be constructed as an addition at the north side of the existing Westside Pump Station. <sup>(1)</sup>

The existing Lake Merced Pump Station will be abandoned. DW flows from the Lake Merced watershed, including those east of Junipero Serra Boulevard now routed to the RSWPCP through Stonestown by gravity, will be rerouted to the WST through the proposed tunnel.

A construction staging area of about 120' x 200' and the tunnel access shaft would be located at the GGNRA parking lot on the westside of the Great Highway Extension at Sloat Blvd.

(1) Subsequent evaluation lead to deletion of the additional pump.  
See Appendix EE, Vol. II, for details.

The tunnel access shaft would have dimensions of 30'x60'x40' deep. A 5.5'+ diameter pipe would be jacked at a 90-degree angle to the tunnel alignment under the Great Highway to the west wall of the Westside Transport at Sloat Boulevard. This pipe would pass through the west and central walls of the Westside Transport and allow the contents of the tunnel to spill in the sump area of the east compartment.

Underground tunneling would proceed from the tunnel shaft at the GGNRA parking lot, under the Great Highway Extension, Skyline Boulevard, and John Muir Drive until it reached a point adjacent to the existing Lake Merced Pump Station (see Figure 7-8). At this point a shaft measuring approximately 25x35x30 feet deep would be constructed for removal of tunneling equipment at the completion of the project. This shaft would be located in the west side of John Muir Drive adjacent to the Lake Merced Pump Station. An excavation approximately 50 feet wide and 35 feet deep would then extend for about 200'+ southward along John Muir Drive to allow construction of a control structure for overflow of wastewater to the existing Lake Merced ocean outfall tunnel during extreme wet weather conditions.

The entire length of the structures will be in sand deposits. Up to about 25 feet of clean to silty, loose to medium sand fill exists along the Great Highway. This fill is underlain by recent dune sand or slightly cemented, dense sands of the Colma formation. The dune and Colma sands prevail along the remainder of the route along Skyline Boulevard and John Muir Drive. For the most part, the tunnel would be in the Colma formation, with some excursions into the looser, uncemented dune sands. The soil conditions are described in greater detail in Harding-Lawson Associates' report "Preliminary Geotechnical Investigation, Lake Merced Transport Project", dated July 28, 1981.

At the northern end of the route, the groundwater table is about two to three feet above the crown. At the southern end, however, the groundwater table is at the invert, and most of the alignment shows the groundwater table within the height of the tunnel. The groundwater is fresh and the groundwater table controlled by seepage from Lake Merced and inland catchment areas.

### **Dry Weather Operation Concept**

All dry weather flows originating in the Lake Merced watershed, including those generated East of 19th Avenue, currently diverted northward, will be rerouted via existing sewers to the proposed diversion/control structure on John Muir Drive. At this point flow will enter the proposed Lake Merced tunnel and gravitate to the Westside transport box to join with the rest of the Westside DW flows. From this point all the DW flow will be pumped to the Oceanside Water Pollution Control Plant (OWPCP) for treatment.

### **Wet Weather Operation Concept**

During wet weather combined flow from the entire Lake Merced drainage area will gravitate via existing sewers southward and westward to a point beneath John Muir Drive just east of the entrance to the new tunnel. This flow will be transported from the 8'-9" by 23'-9", three-compartment storm sewer into the new tunnel after passing through a diversion/control structure. Flows that exceed the Lake Merced Transport design withdrawal rate and storage volume will overflow the weir in the diversion/control structure and follow the existing 10'x11'-3" storm sewer to the existing outfall on the shoreline below Fort Funston.

The WW flow that enters the new tunnel will be transported northward through this tunnel and discharged directly into the east compartment of the West Side Transport to join the WW flows from the other west side drainage areas. There, flow is pumped through the West Side Pump Station into the headworks of the proposed OWPCP for treatment and discharge into the ocean. If the total WW inflow into the WST exceeds the pumping rate to the OWPCP, the excess flow will go into storage until the storage level rises above elevation - 10 feet. Then, flow will decant from the east compartment of the WST into the west compartment after passing through a baffle arrangement that retains floatables. This decanted flow is pumped by the westerly sump of the WSPS and the new lift pump to the SWOO where it combines with the OWPCP effluent and then discharges into the ocean some four miles off-shore. Decanting continues as long as the WST storage level is higher than elevation -10 feet.



### **Additional Considerations**

The overflow structure at the John Muir Drive entrance to the new tunnel will be a side weir, baffled in such a fashion as to prevent objectionable floatables from entering the storm sewer leading to the outfall.

The connection of the low end of the tunnel to the easterly chamber of the West Side Transport (WST) structure will be via a 5.5+/- foot diameter pipe at right angles to the tunnel. This pipe will act as an orifice or flow-control device to keep the discharge from the tunnel into the WST within design limits.

It is anticipated that no long-term accumulation of sediment will take place inside the tunnel. By diverting all Lake Merced DW flows into the tunnel it is expected to achieve post-storm sediment flushing without the need for a separate flushing system.

**TABLE 9-1  
ESTIMATED COST OF  
LAKE MERCED TRANSPORT/STORAGE  
ALTERNATIVE LM-3**

| <b>ITEM NO.</b> | <b>DESCRIPTION</b>               | <b>COST (MILLION \$)</b> |
|-----------------|----------------------------------|--------------------------|
| 1A              | Structures                       | 20.95                    |
| 1B              | Mechanical & Electrical          | 0.45                     |
| 1               | Structures & Mechanical & Elect. | 21.40                    |
| 2               | Contingency (20%)                | 4.28                     |
| 3               | Professional Services (16%)      | 3.42                     |
| 4               | Subtotal                         | 29.10                    |
| 5               | Interest                         | 2.58                     |
| 6               | Total Capital Cost               | 31.68                    |
| 7               | Salvage Value                    | (-)3.40                  |
| 8               | Capital Cost Less Salvage Value  | 28.28                    |
| 9               | Annual Energy                    | .0                       |
| 10              | Annual Labor & Materials         | 0.01                     |
| 11              | Total Annual O&M                 | 0.01                     |
| 12              | Present Worth of O&M             | 0.127                    |
| 13              | Total Present Worth              | 28.40                    |
| 14              | Equivalent Annual Cost           | 3.08                     |

## **IMPLEMENTATION SCHEDULE**

The Lake Merced Transport project is only one project in the ongoing Clean Water Program. The current Program Master Schedule is shown in Figure 9 and represents the best available scheduling information at this time. The critical path schedule for the Lake Merced Transport activities is shown on 9-2.

**TABLE 9-2  
LAKE MERCED TRANSPORT  
PROJECT SCHEDULE**

| <b>ACTIVITY</b>   | <b>DATE</b> |
|---|-------------|
| Complete and Distribute Final Report, obtain EIR Certification, initiate predesign for Step 2 | 11/88       |
| Obtain final approvals, initiate Step 2 design  | 3/89        |
| Complete Step 2 plans and specifications  | 10/90       |
| Obtain final approvals, obtain loan, advertise  | 2/91        |
| Receive bids  | 4/91        |
| Award construction contract   | 8/91        |
| Give Contractor notice to proceed   | 3/91        |
| Complete Construction   | 11/92       |
| Complete facilities startup and implement full service  | 7/93*       |

\*Completion of new Oceanside Treatment Plan

## **REVENUE PLAN**

The San Francisco Clean Water Program is responsible for financial planning of all project elements of the City's wastewater program. The financial plan and revenue program is described in the Clean Water Enterprise Five Year Revenue Plan 1988/89 - 1992/93, adopted by the Board of Supervisors in July 1988.

## **SOURCES OF PROJECT FUNDS**

Two major sources of funds will be used to finance the Lake Merced and Richmond Projects: Federal/state loans and local revenue bonds authorized for sewerage purposes.

Loans will be provided for 100% of eligible project costs if funds are available and the City qualifies. The City will be responsible for all ineligible costs and for repaying the loan over a period up to 20 years at an interest rate equal to one half of the State General Obligation Bond rate at the time of the loan. Authorization for state loans will require adoption of a Charter Amendment by a majority vote of the electorate, or pursuant to the Charter (Chapter 3, Section 7.300) a three quarter vote of the Board of Supervisors for those projects necessary to comply with federal & state laws. The Lake Merced project is under a Cease and Desist Order of the State Regional Water Quality Control Board.

Under current law, EPA and SWRCB may provide an allowance in the construction loan for design costs as a percentage of the construction cost. Therefore, the City must fund design costs from its own resources until it receives Federal/State construction loans following completion of design.

Existing revenue bond authorizations (the latest adopted 7/88) are sufficient to provide funds for the City's share of costs. Sewer revenue bonds are issued pursuant to Resolution No. 973-77 of the Board of Supervisors. Section 6.15 of Resolution No. 973-77 provides the City shall at all times, while any of the bonds remain outstanding, fix and collect rates, fees, and charges for service of the sewerage system so as to yield net revenues in each fiscal year equal to at least 1.25 times debt service becoming due on the bonds in that year.

#### **FINANCING CAPACITY**

Sewer service charge rates and procedures, in compliance with the SWRCB Revenue Program Guidelines, were adopted in June 1977, and approved by the EPA.

The current sewer service rates, and systemwide operations, maintenance, and debt service costs are described in detail in the Clean Water Enterprise Revenue Plan. The Clean Water Enterprise budget provides a debt coverage ratio of 1.32, which exceeds the coverage required under the City's bond ordinance.

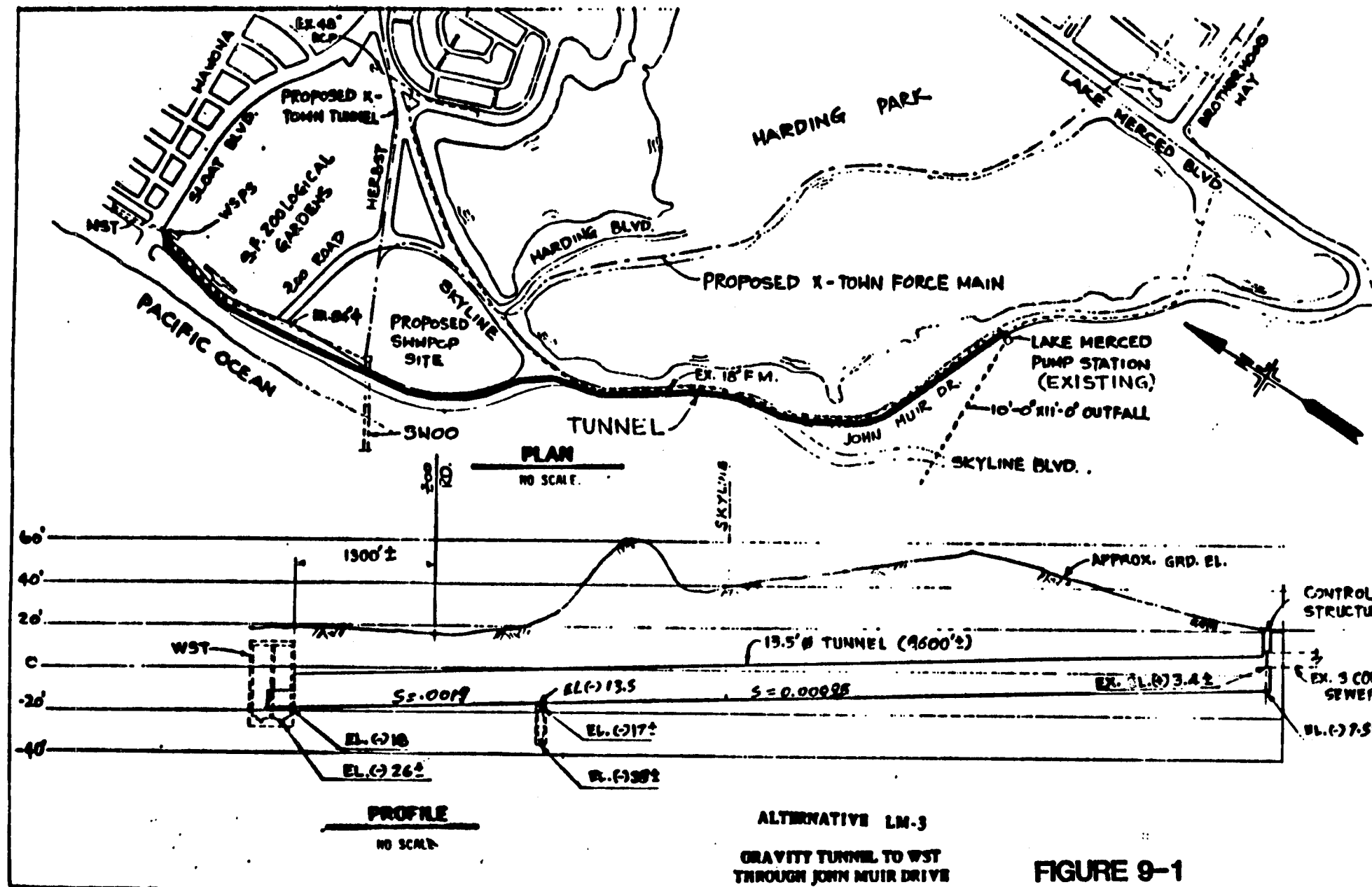
#### **OPERATION AND MAINTENANCE**

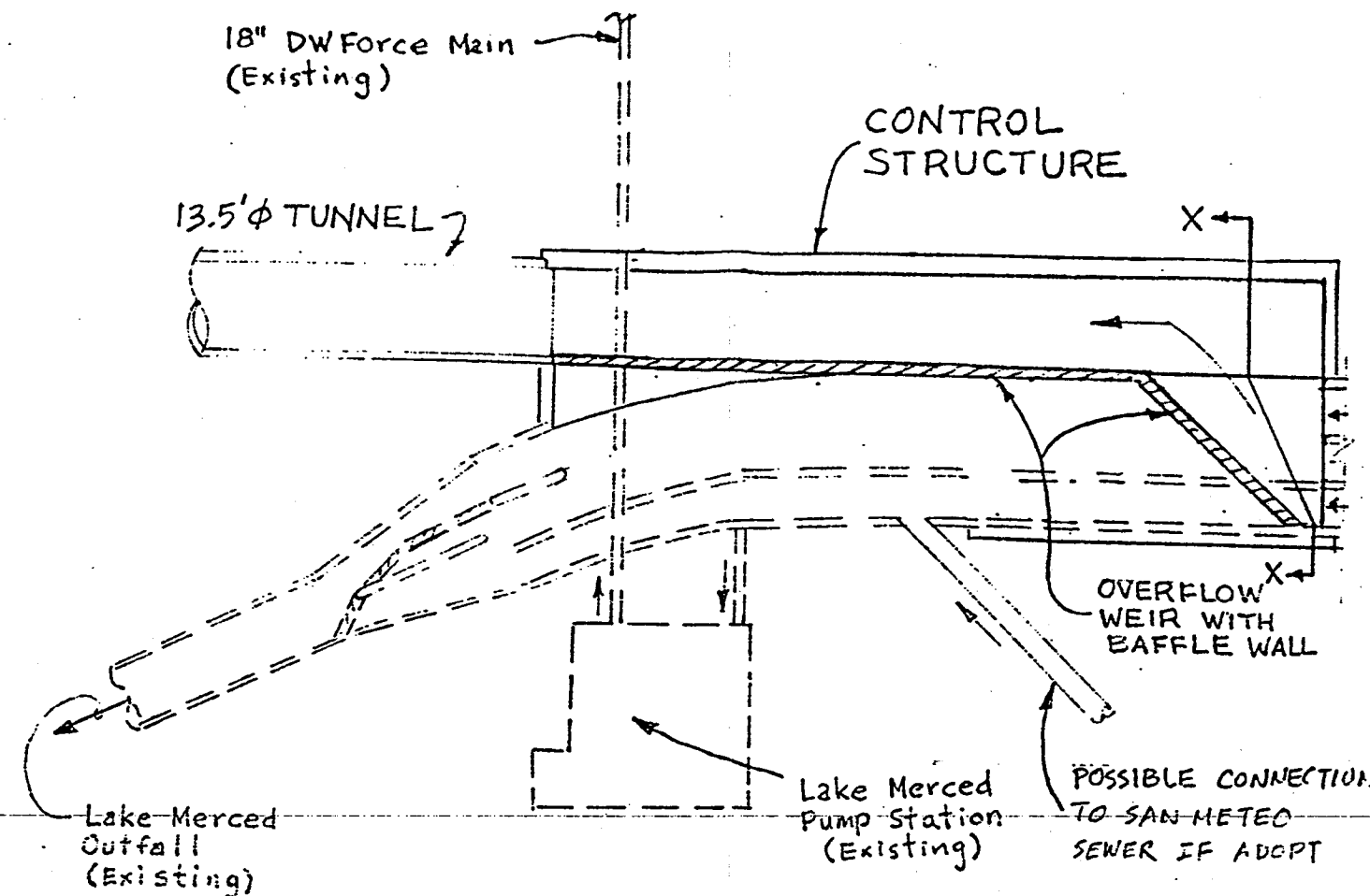
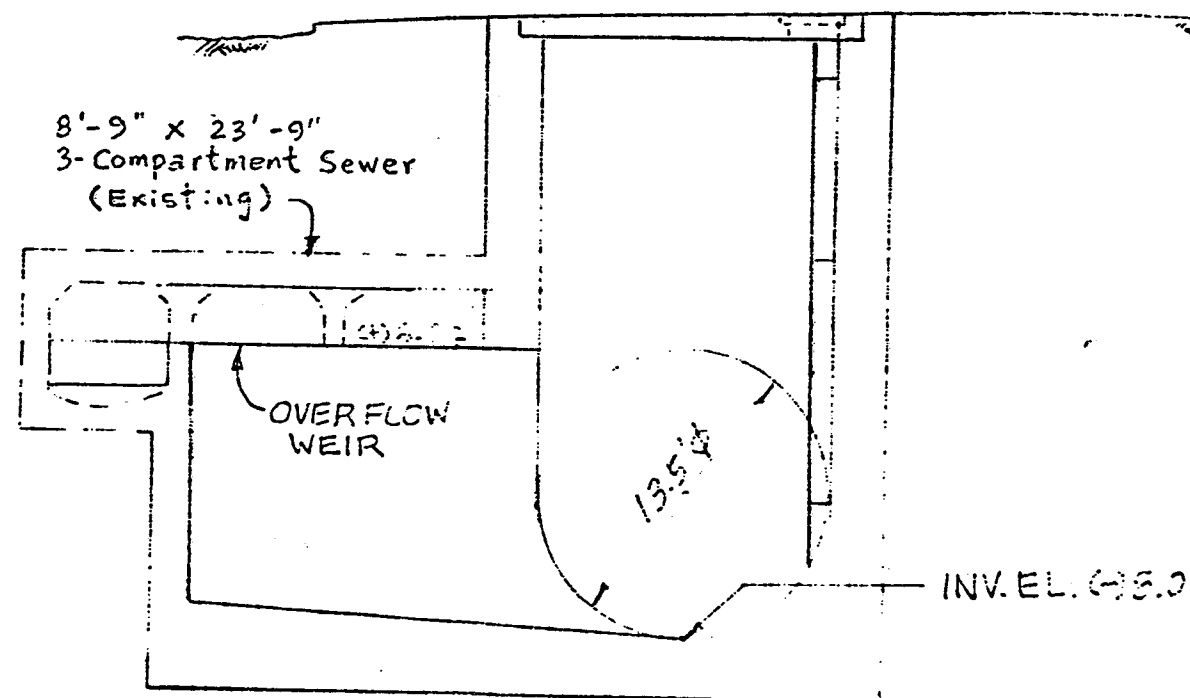
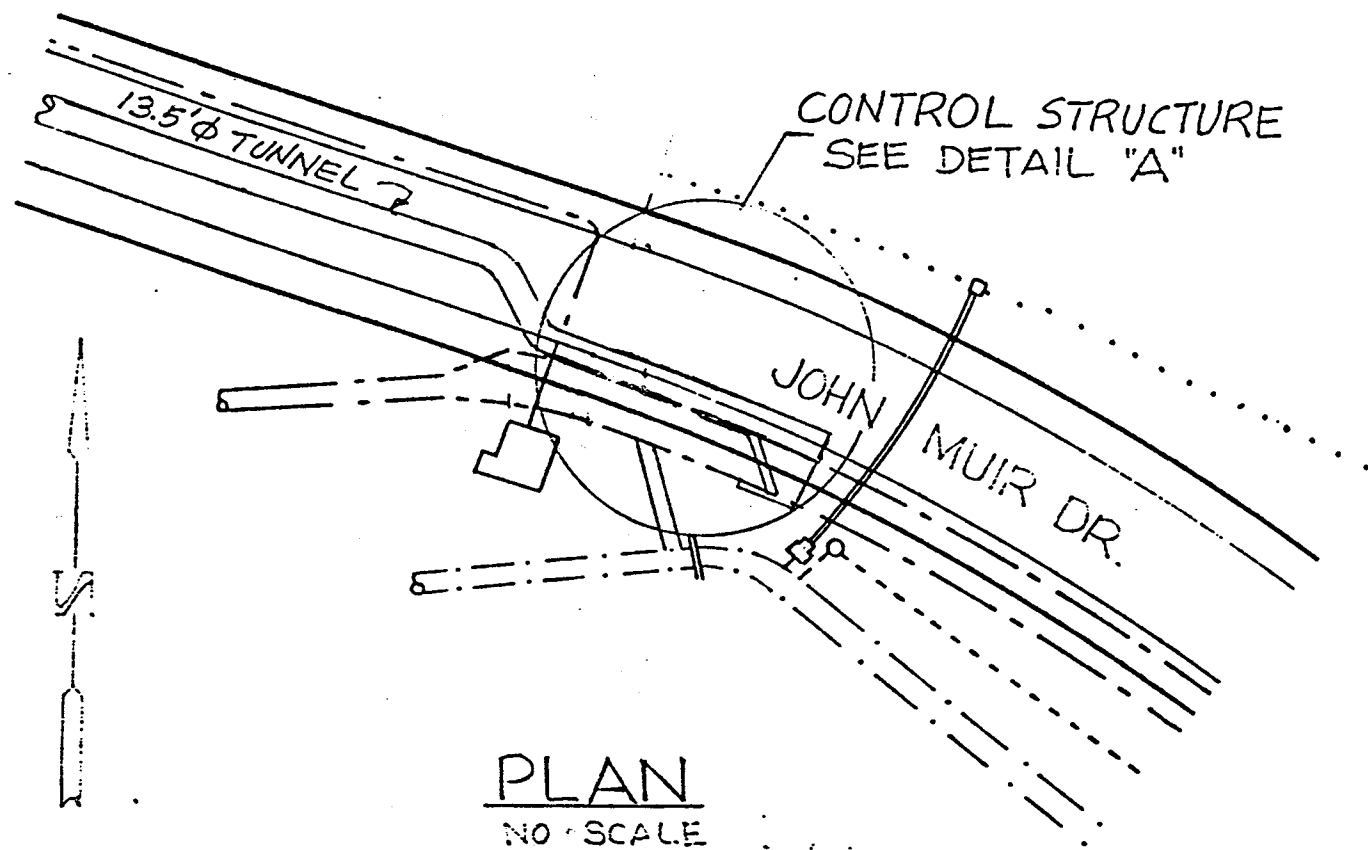
The continuing successful performance of the Lake Merced Transport Storage Facility will rely on a good operations and maintenance program. Most of the operational requirements for the apparent best alternatives are associated with the Westside Pump Station. These operations will vary significantly with the season.

A minimum of attention will be required by operating personnel during dry weather. Also, the dry weather season is the best time to perform major maintenance on wet weather pumps and associated equipment since they will not need to be placed in service at short notice. The use of electric motors to drive the pump

eliminates the problem of frequent exercise that would be required to keep internal combustion engines ready for service. Electric drives also require a minimum of maintenance for wear.

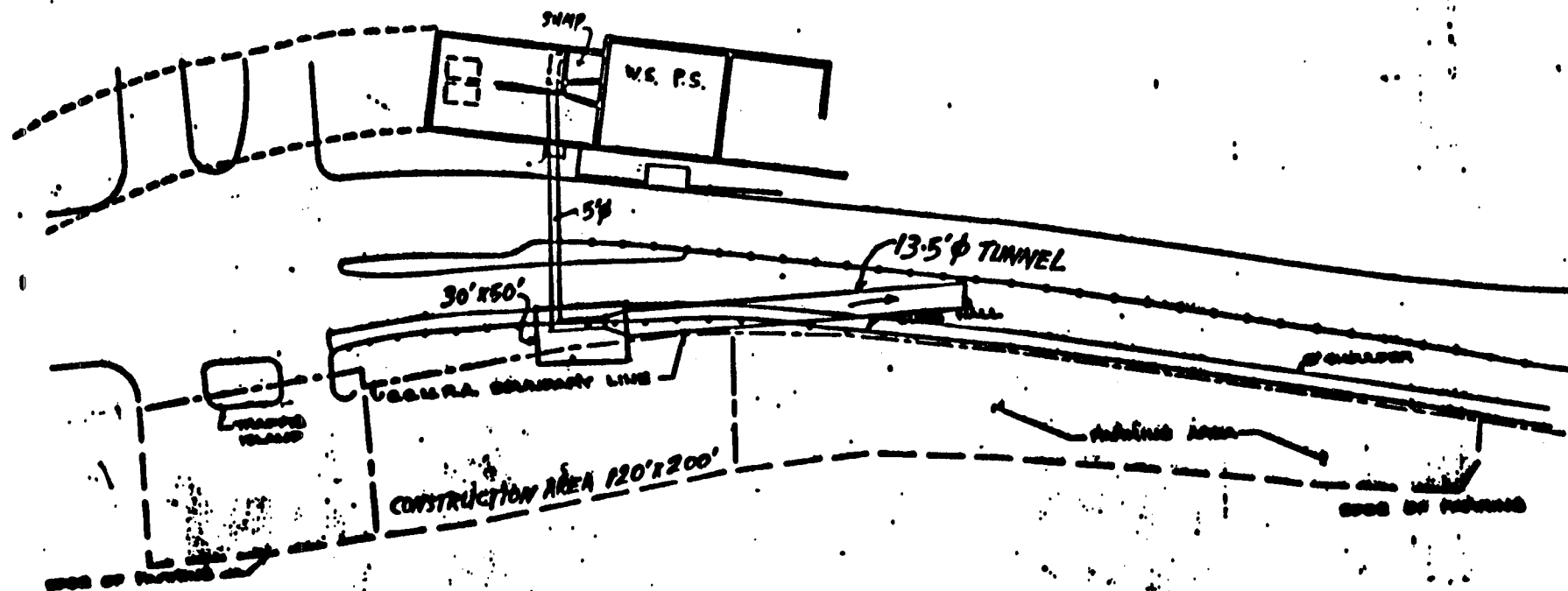
The operations and maintenance of the facilities will be the responsibility of the Department of Public Works, Bureau of Water Pollution Control. Personnel requirements will be greater during wet weather months than dry weather months. No permanent on-site personnel will be assigned to the facilities at any time; roving crews will periodically inspect the facilities.





DETAIL "A"

|  |   |
|--|---|
|  | CITY AND COUNTY OF SAN FRANCISCO<br>CLEAN WATER PROGRAM |
|  | LAKE MERCED TRANSPORT<br>ALTERNATIVE LM-3<br>DETAIL     |
|  | FIGURE 9-2  |
|  | CHANGE<br>1   |



LAKE MERCED TUNNEL  
SCALE 1" = 60'

FIGURE 9-3

**APPENDIX A**

**NPDES PERMIT CA 0038415**

**ORDER NO. 76-23**

**AND**

**ORDER NO. 79-12**

**Appendix A  
Facilities Planning**



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FINAL  
REC'D  
5/3/76

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
SAN FRANCISCO BAY REGION

ORDER NO. 76-23

NPDES PERMIT NO. CA 0038415

WASTE DISCHARGE REQUIREMENTS FOR:

CITY AND COUNTY OF SAN FRANCISCO  
RICHMOND SUNSET SEWERAGE ZONE  
WET WEATHER DIVERSION STRUCTURES

*amended by  
Order #  
79-12*

The California Regional Water Quality Control Board, San Francisco Bay Region, hereinafter called the Board, finds that:

1. The City and County of San Francisco, hereinafter called the discharger, presently discharges untreated domestic and industrial wastewater mixed with storm water runoff, all containing pollutants, into San Francisco Bay, a water of the United States.
2. The combined wastewater is discharged through any of eight (8) wet weather diversion structures whenever the rainfall exceeds 0.02 inches per hour in the drainage area tributary to that structure. Discharge occurs on beaches and along the shoreline.
3. The wet weather diversion structures are described below:

| DISCHARGE<br>Number | Name            | OUTFALL SIZE<br>Width X Height<br>or Diameter | Elevation of<br>Crown to<br>MHLW (b) | PEAK FLOW<br>During 5 yr<br>Storm (c) -MGD (d) | DISCHARGE<br>LOCATION |
|---------------------|-----------------|---|--------------------------------------|--|-----------------------|
|                     |                 |   |                                      |  |                       |
| 1                   | Lake Merced     | 10'x11.25'                                    |                                      | 614  | Fort Funston<br>Beach |
| 2                   | Vicente         | 2 (a) -5'                                     |                                      | 413  | Vicente Beach         |
| 3                   | Lincoln Way     | 3 -6.5'                                       |                                      | 840  | Lincoln Beach         |
| 4                   | Mile Rock       | 9'x11'  |                                      | 514  | Mile Rock<br>Beach    |
| 5                   | Sea Cliff PS #1 | 1'6"  |                                      | 5  | Phelan Beach          |
| 6                   | Sea Cliff       | 6'  |                                      | 386  | Bakers Beach          |
| 7                   | Sea Cliff PS #2 | 1'  |                                      | 10   | Bakers Beach          |
| 8                   | Bakers Beach    | 7'  |                                      | 710  | Bakers Beach          |

(a) Number of barrels

(b) Mean Lower Low Water

(c) These flows result for a short period from a peak rainfall intensity of 1.5 inches per hour

(d) Million Gallons per Day

4. The discharger's long-range plans are to construct facilities to store, transport and treat the combined wastewater from the entire city for discharge to the ocean in the vicinity of Lake Merced (Southwest plant). This plan, hereinafter called the Master Plan, was approved in concept by the San Francisco Board of Supervisors on January 27, 1975.

5. The Master Plan would reduce the frequency of discharge of untreated wastewater from a present average of 82 times per year to a range of eight per year to one in five years depending upon the capacity of storage and treatment provided.
6. Initial facilities for the Richmond Sunset Zone will include consolidation of diversion structures, storage, transport and an ocean outfall off Lake Merced.
7. The Board, on April 8, 1975, adopted a Water Quality Control Plan for the San Francisco Bay Basin. That plan contains a prohibition against the discharge of untreated sewage, water quality objectives for San Francisco Bay and a recommended approach for regulating the discharge from wet weather diversion structures which recommends that exceptions to compliance be allowed provided that beneficial uses are not adversely affected.
8. The combined sewer collection system of San Francisco, designed to transport both sanitary and storm flows, presents a unique problem regarding total compliance with the Basin Plans prohibition against the discharge of untreated waste. The high cost of requiring total compliance at this time and because the discharger has not done the benefit-cost analysis recommended by the Basin Plan requires that a staged program of facility construction be undertaken. The specific level of overflow control required for the first stage will be established on a case-by-case basis considering the overflow frequencies recommended by the discharger. This Board intends to consider amending the Basin Plan to provide for exceptions to total compliance with the prohibition against the discharge of untreated waste for wet weather flows.
9. The beneficial uses of San Francisco Bay in the vicinity of these diversion structures are:
  - Water contact recreation
  - Non-contact water recreation
  - Marine habitat
  - Open commercial and sport fishing
  - Fish migration
  - Wildlife habitats
10. Effluent limitation, national standards of performance, and toxic and pretreatment effluent standards established pursuant to Sections 208(b), 301, 302, 303(d), 304, and 307 of the Federal Water Pollution Control Act and amendments thereto are applicable to the discharge.
11. The Board has notified the discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the discharge and has provided them with an opportunity for a public hearing and an opportunity to submit their written views and recommendations.
12. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

13. This Order shall serve as a National Pollutant Discharge Elimination System permit pursuant to Section 402 of the Federal Water Pollution Control Act, or amendments thereto, and shall take effect at the end of ten days from date of hearing provided the Regional Administrator, U. S. Environmental Protection Agency, has no objections.

IT IS HEREBY ORDERED, that the City and County of San Francisco in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder and the provisions of the Federal Water Pollution Control Act and regulations and guidelines adopted thereunder, shall comply with the following:

A. Discharge Prohibitions

1. Discharge of untreated waste to waters of the State is prohibited.
2. Discharge of waste into dead-end sloughs or similar confined water areas or their tributaries is prohibited.
3. Discharge of waste at any point where it does not receive a minimum initial dilution of at least 10:1 is prohibited.
4. Discharge of dry weather waste from wet weather diversion structures is prohibited.

Exceptions to prohibitions 2 and 3 will be considered where an inordinate financial burden would be placed on the discharger relative to beneficial uses protected and when an equivalent level of environmental protection can be achieved by alternate means.

B. Provisions

1. The discharge of pollutants shall not create a nuisance as defined in the California Water Code.
2. Specific effluent and receiving water limitations applicable to wet weather discharges from the proposed Southwest plant will be prescribed in separate waste discharge requirements.
3. The discharger shall comply with the following time schedules to assure compliance with the discharge prohibitions and provisions of this Order:

a. Compliance with Discharge Prohibition A.1.:

TASK

COMPLETION DATE

(1)<sup>1/</sup> Reduce frequency of discharge for diversion structures No. 1 through 8 to an average<sup>2/</sup> of one overflow event per year.

<sup>1/</sup>This Board will consider amendment of this order to further reduce frequency of discharge after review of the information requested in Provision B.4. below.

<sup>2/</sup>Method of computing average to be developed in self-monitoring program.

(a) Westside Transport

This Regional Board will establish a time schedule for construction after receipt of additional information from the City in May 1976.

- (b) Submit time schedule for additional facilities necessary for compliance with one overflow event per year. by July 1, 1977 •

(c) Southwest wet weather treatment plant

1. Submit analysis of available record of citywide rain/gage network to verify capacity of Southwest wet weather plant. Include estimate of hours of operation per year at various treatment rates and estimated wet weather pumping rates from outfall consolidation projects. by July 1, 1976 •
2. Submit time schedule for tasks 3 through 19. by July 1, 1976
3. Submit facilities plan to SWRCB which includes documentation of compliance with discharge requirements specified in NPDES permit for the southwest plant.
4. Complete draft Environmental Impact Report (EIR) and file notice required by law.
5. Conclude public hearing(s) and comments on draft EIR.
6. Complete and certify final EIR.
7. Obtain city Master Plan approval from City Planning Commission.
8. Board of Supervisors approval, if necessary
9. Submit formal applications to Local, State and Federal agencies, including but not limited to State Coastal Commission, California National Guard, US Army, US Congress to allow use of land.

TASKCOMPLETION DATE

10. Receive formal approval for those applications submitted in "9" above.
11. Receive formal approval from the city regarding conformance with the Zoo Master Plan.
12. Contract consultant, if determined to be necessary, for design.\*
13. Complete preliminary engineering, transmit 10% design to SWRCB for review.\*
14. Transmit 50% design to SWRCB for review.\*
15. Transmit final plans and specifications to SWRCB for review.\*
16. Begin construction\*
17. Complete 50% of construction contract.\*
18. Complete construction.\*
19. Compliance with requirements

\*Separate time schedules for major portions of the Southwest Plant should be submitted for these tasks.

b. Compliance with Discharge prohibitions A.2. and A.3.:

TASKCOMPLETION DATE

- (1) Submit preliminary cost estimates for proposed outfall extensions assuming 10:1 initial dilution by July 1, 1976
- (2) The discharger shall undertake a revised citywide overflow control study as required by this Board's Water Quality Control Plan (Basin Plan) adopted in April 1975 and further defined in Provision B.4. below
  - (a) Submit detailed study plan acceptable to Executive Officer by November 1, 1976
  - (b) Commence initial portion of study pursuant to the approved study plan by December 1, 1976
  - (c) Submit initial report of study date, findings, conclusions and recommendations, by July 1, 1977

c. Compliance with Provision B.1.:

TASK

COMPLETION DATE

- (1) Complete evaluation of beach cleaning equipment or other means of reducing sewage solids on beaches.

by October 1, 1976

d. Compliance with Prohibition A.4:

immediately upon adoption of this Order

The discharger shall submit a report to the Board within 15 days following each completion date, detailing his compliance or noncompliance with the specific schedule date and task. If noncompliance is being reported, the reasons for such noncompliance shall be stated, plus an estimate of the date when the discharger will be in compliance. The discharger shall notify the Board by letter when he has returned to compliance with the time schedule.

4. The study required by Provision B.3.b.(2) shall identify various zones along the shoreline as determined by the beneficial uses listed in paragraph 9 of this Order. A recommended frequency of overflow and recommended outfall extensions shall be developed for each zone based upon consideration of all the following factors: *done*

- not done*
- (a) The water quality objectives for protection of these beneficial uses included in this Board's Basin Plan;
  - (b) The location of proposed outfall extensions and their effect upon compliance with water quality objectives and beneficial uses of adjacent zones;
  - (c) Various outfall lengths and resultant depth of discharge, initial dilution, dilution at shoreline, net movement of effluent field;
  - (d) Cost-effective combinations of storage, outfall location and length and treatment (floatable reduction and disinfection) to achieve various degrees of compliance with water quality objectives particularly in terms of coliform organisms, aesthetics and toxicity.

5. The requirements prescribed by this Order amend the requirements prescribed by Resolution No. 67-2 and are effective on the dates of compliance prescribed in the above time schedule PROVIDED HOWEVER that the following requirements prescribed in Resolution 67-2 shall remain in effect and be in addition to the requirements prescribed in this Order until Cease and Desist Orders Nos. 73-35 and 76-5 are rescinded by this Board:

Waste Discharge Requirements:

Section VIII: A.1, A.3, A.6, A.7, B. and C  
Section IX

6. This Order includes items 1, 4, and 5 of the attached "Reporting Requirements", dated August 8, 1973.
7. This Order includes all items of the attached "Standard Provisions", dated August 8, 1973.
8. This Order expires on March 1, 1981 and the discharger must file a Report of Waste Discharge in accordance with Title 23, California Administrative Code, not later than 180 days in advance of such date as application for issuance of new waste discharge requirements.
9. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the discharger, the discharger shall notify the succeeding owner or operator of the existence of this Order by a letter, a copy of which shall be forwarded to this Board.

I, Fred H. Dierker, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on March 16, 1976.

---

FRED H. DIERKER  
Executive Officer

**Attachments:**

Reporting Requirements 8/8/73  
Standard Provisions 8/8/73

17cc

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
SAN FRANCISCO BAY REGION

ORDER NO. 79-12

NPDES PERMIT NO. CA0038415

AMENDING ORDER NO. 76-23 REGARDING  
CITY AND COUNTY OF SAN FRANCISCO  
RICHMOND SUNSET SEWERAGE ZONE  
WET WEATHER DIVERSION STRUCTURES

The California Regional Water Quality Control Board, San Francisco Bay Region, hereinafter called the Board, finds that:

1. The City and County of San Francisco, hereinafter called the discharger, presently discharges untreated domestic and industrial wastewater mixed with storm water runoff, all containing pollutants, into the Pacific Ocean, a water of the United States, through any of eight (8) wet weather diversion structures in the Richmond Sunset Sewerage Zone. These discharges occur only when rainfall exceeds 0.02 inches per hour.
2. Order No. 76-23 required the discharger to reduce the frequency of discharge for diversion structures No. 1 through 8 to an average of one overflow event per year and to undertake a citywide overflow control study to better define the cost and water quality benefits of facilities designed to achieve various overflow frequencies.
3. The discharger has undertaken an overflow control study and has requested the Regional Board to consider an increase in the allowable frequency of discharge for diversion structures No. 1 through 8 from an average of 1 overflow per year to an average of 8 overflows per year.
4. The following table provides a comparison of improvement obtainable by reducing the average overflows from diversion structures No. 1 through 8 to eight (8), four (4) and one (1) overflow per year compared to the existing average of 114 per year. Data was derived from the discharger's predictive computer model and are therefore approximations.



| Average Number of Overflows Per Year | Existing<br>114 | 8 | 4 | Order<br>No. 76-23<br>1 |
|--------------------------------------|-----------------|---|---|-------------------------|
|--------------------------------------|-----------------|---|---|-------------------------|

|   |         |      |      |       |
|---|---------|------|------|-------|
| Minimum/maximum number of overflows per year  | 26/193  | 1/18 | 0/11 | 0/4   |
| % of annual combined wastewater treated (avg.)  | 74.1    | 95.9 | 98.1 | 99.53 |
| % of annual combined wastewater which overflows (avg.)  | 25.9    | 4.1  | 1.9  | 0.47  |
| Volume of overflow (Million gallons/year, avg.)   | 2870    | 449  | 213  | 52    |
| Total hours of overflow per year (avg)  | 372     | 32   | 15.4 | 3.5   |
| Minimum/maximum hours of overflow per year  | 163/617 | 2/78 | 0/42 | 0/18  |
| Average duration of overflow (hours)  | 3.3     | 4    | 3.9  | 3.5   |
| Composition of overflows (avg)  |         |      |      |       |
| % sewage  | 12      | 6.5  | 6.5  | 6.2   |
| % storm water   | 88      | 93.5 | 93.5 | 93.8  |
| % reduction in BOD <sub>5</sub> and Suspended Solids discharged from existing overflows (avg)                             | base    | 84   | 92.5 | 98    |
| Average number of days nearshore water adjacent to discharge points exceed coliform standards for body contact recreation |         |      |      |       |
| days greater than 1000 MPN/100 ml   | 119     | 25   | 13   | 4     |
| days greater than 10,000 MPN/100 ml   | 70      | 10   | 6    | 1     |
| Cost of facilities (millions of dollars)  |         |      |      |       |
| Capital cost (total)  | base    | 189  | 242  | 299   |
| Storage   |         | 150  | 161  | 182   |
| Pumping   |         | 13.5 | 21.5 | 25.5  |
| Treatment/outfall   |         | 25.5 | 59.1 | 91.6  |
| Annual cost   | base    | 14   | 19   | 24    |

5. Overflows will occur from storage structures which will be designed to provide for additional removal of settleable and floatable solids. Removal of these solids will provide further mitigation of the aesthetic and public health impacts over and above the mitigation provided by reduction in the frequency of overflows.

6. The discharger completed a final EIR/EIS for the Wastewater Master Plan in May 1974. The discharger completed a final EIR for the Westside Transport facility in July, 1977, which addressed overflows from diversion structures Nos. 2 and 3. This EIR identified potential adverse water quality impacts from this project related to seismic activity and the project has been modified to mitigate this potential impact. This EIR will be amended by the City following adoption of this order. The discharger has commenced preparation of a draft EIR for the Richmond Tunnel facility which will address overflows from diversion structures Nos. 4 through 8 and has indicated they will prepare an EIR for the Lake Merced Transport facility which will address overflows from diversion structure No. 1. Upon completion of the amendment to the Westside Transport facility EIR, the final EIR for the Richmond Tunnel facility, and the final EIR for the Lake Merced Transport facility, the Board will review any adverse water quality impacts identified, and if necessary, make appropriate revisions of this Order. The issuance of waste discharge requirements for this project is exempt from the provisions of Chapter 3 (commencing with Section 21000) of Division 13 of the California Public Resources Code (CEQA) in accordance with Water Code Section 13389.
7. The Board has notified the discharger and interested agencies and persons of its intent to amend Order No. 76-23 and has provided them with an opportunity for a public hearing and an opportunity to submit their written views and recommendations.
8. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.
9. The combined sewer collection system of San Francisco, designed to transport both sanitary and storm flows, presents a unique problem regarding total compliance with the Basin Plan prohibition against the discharge of untreated waste. The Basin Plan recommends that exceptions to compliance be allowed for wet weather discharges, provided that beneficial uses are not adversely affected; however, a specific exception clause was not included. It is clear that the intent of the Basin Plan is to allow exceptions and this Board will consider inclusion of a specific exception clause during the next Basin Plan updating.
10. Based upon the presently available planning information contained in these findings and evidence presented at the public meeting concerning the cost differences of facilities necessary to achieve specific overflow frequencies and the water quality benefits derived from construction of those facilities and considering the location and intensity of existing beneficial uses; a long term average of eight (8) overflows per year for diversion structures No. 1 through 8, will provide adequate overall protection of beneficial uses; provided however that further study to comply with the discharge prohibitions No. A.2 and A.3 is required by the discharger especially where existing discharge points are located in areas which do not have adequate exchange with ocean water and may not provide adequate protection of adjacent nearshore beneficial uses. Further mitigation may be required in the future, after facilities are placed in operation, if it is determined that beneficial uses are not adequately protected.

11. The Federal Water Pollution Control Act and amendments thereto require that point source discharges comply with appropriate standards by July 1, 1977. The discharger has not started construction of facilities to comply with the prohibitions and provisions of Order No. 76-23 as amended by this Order. The Board will consider an appropriate enforcement order which will include a time schedule for compliance with Order No. 76-23 as amended by this order within 90 days of the date of this order.

~~ORDER NO. 76-23~~, that Order No. 76-23 is amended as follows:

A. Finding No. 1, page 1, is amended to read:

1. The City and County of San Francisco, hereinafter called the discharger, presently discharges untreated domestic and industrial wastewater mixed with storm water runoff, all containing pollutants, into the Pacific Ocean, a water of the United States.

B. Finding No. 8, page 2, is deleted.

C. Finding No. 9, page 2, is amended to read:

9. The beneficial uses of the Pacific Ocean in the vicinity of these diversion structures are:

Water contact recreation  
Non-contact water recreation  
Marine habitat  
Commercial and sport fishing  
Fish migration  
Wildlife habitats

D. Discharge prohibition A.1, page 3, is amended to read:

1. Discharge of untreated waste to waters of the State is prohibited with the exception of allowable overflows as defined below. ~~The city shall design and construct facilities for diversion structures b. 1-8 to achieve a long term average of eight (8) overflows per year from these facilities. These long term overflow frequencies shall not be used to determine compliance or noncompliance with the exception. Allowable overflows from these facilities are defined as those discharges which occur when all of the following criteria are met:~~

- a. All storage capacity within a storage facility is fully utilized; and
- b. Maximum installed pumping capacity or some lower rate based on limits of downstream transport or treatment capabilities is being utilized to withdraw flows from the storage facility; and

- c. All citywide treatment facilities, excluding the Golden Gate Park reclamation facility, are being operated at capacity or at some lower rate consistent with the maximum withdrawal and transport rates; and
- d. Overflow occurs from a facility employing baffles or other equivalent means to reduce the discharge of floatables.

Overflows which occur when criteria a, b, c, and d are not being met shall be considered violations of this discharge prohibitions.

E. Provision B.3.a., page 3, is amended to delete the following:

"(1) <sup>1/</sup>Reduce frequency of discharge for diversion structures No. 1 through 8 to an average <sup>2/</sup>of one overflow event per year.

<sup>1/</sup>This Board will consider amendment of this order to further reduce frequency of discharge after review of the information requested in Provision B.4. below.

<sup>2/</sup>Method of computing average to be developed in self-monitoring program."

F. Provision B.3.a is amended to add the following on page 5:

| <u>Task</u>  | <u>Completion Date</u> |
|--|------------------------|
| "(d) Full compliance with Discharge Prohibition A.1. | by July 1, 1977"       |

G. Provision B.3.b. is amended to add the following on page 5:

| <u>Task</u>   | <u>Completion Date</u> |
|---|------------------------|
| "(3) Full compliance with Discharge Prohibition A.2. and A.3. | by July 1, 1977"       |

H. Provision B.3.c. is amended to add the following on page 6:

| <u>Task</u>                              | <u>Completion Date</u> |
|--|------------------------|
| "(2) Full compliance with Provision B.1. | by July 1, 1977"       |

I. Provisions No. B. 10., 11., and 12. are added on page 7 as follows:

"10. The City and County of San Francisco is required to submit to the Regional Board by the first day of every month a report, under penalty of perjury, on progress towards compliance with this Order. Said report shall include the status of progress made toward compliance with all tasks of this Order. If noncompliance or threatened noncompliance is reported the reasons for noncompliance and an estimated completion date shall be provided.

11. The long term average overflow frequency prescribed in this Order is based on information available at the time of adoption of this Order. If the Board finds that changes in the location, intensity or importance of affected beneficial uses or demonstrated unacceptable adverse impacts as a result of operation of the constructed facilities have occurred they may require the construction of additional facilities or modifications of the operation of existing facilities.
12. The City and County of San Francisco shall perform a self-monitoring program in accordance with the specifications prescribed by the Executive Officer of the Regional Board. The City and County's Health Department is requested to post warning signs on all beaches affected by the wet weather overflows for a period of time commencing with the day of overflow and continuing until the water analyses indicate the water quality of the affected areas have recovered and are meeting bacteriological standards for water contact sport recreations in the beach areas."

I, Fred H. Dierker, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on January 16, 1979.

FRED H. DIERKER  
Executive Officer

**Attachments:**

Reporting Requirements 8/8/73  
Standard Provisions 8/8/73

## **APPENDIX C**

### **LAKE MERCED AND RICHMOND FACILITIES HYDROLOGIC EVALUATION OF ALTERNATIVES**

#### **BACKGROUND**

The Lake Merced and Richmond watersheds belong to the Westside Core System which contributes approximately 24 percent of the City's total combined sewage flow. Operational elements of the Westside Core System include the Westside Transport (WST), a 49.3 million gallon storage facility, the Westside Pump Station (WSPS), the Richmond Sunset Water Pollution Control Plant (RSWPCP) and the Southwest Ocean Outfall (SWOO). These elements, operating together according to a predetermined scheme, have reduced combined sewer overflows to Ocean Beach from an average of 58 to an average of 8 overflows per year. Prior to the construction of the proposed Lake Merced and Richmond facilities, the RSWPCP will be replaced by the Oceanside Water Pollution Control Plant (OWPCP) which will have a secondary treatment capacity of 43 mgd.

Work performed during the various stages of the Richmond and Lake Merced Facilities Planning Project has dealt with a broad range of facility sizes and combinations thereof. The objective is to select the sizes of storage and/or pumping facilities that would reduce combined sewer overflows from the two areas to an average of 8 times per year. The primary criteria considered during these evaluations was compatibility of the proposed facilities with existing operational elements and subsequently the proposed OWPCP which will replace the RSWPCP. In the case of Lake Merced, hydraulic impacts of the proposed facilities on the existing flow regime were also addressed.

Earlier proposals to incorporate wet weather flow from Daly City into the Lake Merced/Westside Transport system were abandoned due to the large size of additional storage that would be required. The possibility of future diversion of dry weather effluent from North San Mateo County Sanitation District (NSMCSD) to SWOO also was considered but later dropped from this investigation.

Screening of the findings as they evolved from a number of preliminary hydrologic investigations resulted in the identification of a matrix of viable facility size alternatives which were subsequently subjected to a more detailed analysis. This report describes the results of the most recent analysis with emphasis on the proposed Lake Merced Facilities.

## **PURPOSE**

The purpose of this report is to present the results of hydrologic investigations conducted to determine storage and withdrawal requirements in the Richmond and Lake Merced areas with emphasis on Lake Merced, the primary objective of this study. The report provides alternative storage and transport facility sizes which would reduce the number of combined sewer overflows (CSO) in Richmond and Lake Merced from the current frequency of 58 per year to 8 per year as mandated by the NPDES permit requirements.

## **THE WESTSIDE SYSTEM**

The westside area lies to the west of the hydrologic divide that crosses the City in a general north-south direction. Hydrologically this area is subdivided into three major watersheds, the Richmond area to the North, the Sunset area in the center and the Lake Merced area to the south. Simplified representations of the hydraulic interrelationships among the three watersheds are depicted in the schematics of Figure 1 and Figure 1A which show the existing westside core system and its main operational elements respectively before and after construction of the Oceanside Water Pollution Control Plant (OWPCP). These operational elements include the following:

- The Westside Transport (WST), a 49.3 million gallon (MG) storage facility which intercepts all combined flows from the Sunset area.
- The Westside Pump Station (WSPS) which pumps decanted wet weather (WW) flow to the Southwest Ocean Outfall (SWOO) and dewateres the WST box at the end of storms, conveying the stored flow to the Richmond Sunset Water Pollution Control Plant. The WSPS and the WST have reduced the number of CSO's to Ocean Beach from 58 to an average of 8 overflows per year.
- The RSWPCP, a 45 mgd primary treatment plant which treats all dry weather flows plus some WW flow from the westside area. The plant effluent gravitates to the SWOO and is discharged into the Pacific ocean about 4-1/4 miles from the shoreline. The RSWPCP will be replaced by the Oceanside Water Pollution Control Plant (OWPCP), currently under design.
- The SWOO, a 4-1/4 mile long outfall which discharges decanted WW flow and RSWPCP effluent to the Pacific Ocean.

To bring the entire westside area into compliance with CSO and NPDES permit requirements it will be necessary to build additional storage, transport and/or pumping facilities in the two remaining areas of Richmond and Lake Merced.

## **PLANNING CRITERIA**

The hydrologic/hydraulic analysis of the proposed facilities was premised on the following criteria:

- a. Compliance with NPDES permit requirements, i.e., the proposed facilities should reduce combined sewer overflows in Richmond and Lake Merced to an average of 8 per year.
- b. Compatibility with existing and future elements of the westside core system and operational philosophy thereof.
- c. No adverse effects on upstream sewer hydraulics and downstream outfall structures during design storm conditions.
- d. Maximize the use of gravity flow conditions to minimize operating costs.

Other criteria such as environmental, geotechnical, public acceptability, constructibility, etc. are beyond the scope of this investigation and were not considered.

## **CONSTRAINTS AND LIMITATIONS**

The proposed Richmond and Lake Merced facilities will be connected physically or operationally with the existing westside core elements and the future Oceanside Water Pollution Control Plant (OWPCP).

Maximizing the use of the existing facilities such as the Westside Transport (WST), the Westside Pump Station (WSPS) and the Southwest Ocean Outfall (SWOO) would, in principle, result in smaller hence less expensive facilities in Richmond and Lake Merced. However, physical and/or operational constraints limit the degree to which the use of some of the existing elements can be maximized. A description of the existing westside core elements, a discussion of the possibility of maximizing their use and the underlying limitations is presented below:

### **a. The Westside Transport (WST)**

The WST has a usable storage volume of 49.3 million gallons (MG) all of which is currently utilized and will continue to be utilized after construction of the proposed Richmond and Lake Merced facilities. Maximizing decanting, within practical limits, in the WST is also feasible with no additional construction.



**b. The Westside Pump Station (WSPS)**

Following construction of the OWPCP, the three pumps in the easterly sump of the WSPS will be dedicated to pumping flows from the east chamber of the WST to the OWPCP. The remaining four pumps, all in the westerly sump of the WSPS, will continue to pump decanted flow to SWOO during wet weather. These four pumps have a maximum pumping capacity of about 88 mgd, a limiting factor in the conveyance of decanted flow to SWOO. By adding lift pumps in the westerly chamber of the WST just upstream of the WSPS, the capacity to pump decanted flow to SWOO can be increased substantially. However, as decanted flow increases and the HGL in the SWOO junction rises, the 7-foot diameter conduit that conveys pumped decanted flow to SWOO will become the limiting factor.

**c. The Southwest Ocean Outfall (SWOO)**

The SWOO is a 4-1/4-mile long, 12-foot diameter underwater outfall. Its 85 risers, when all are open, would permit the discharge of both westside and bayside flows into the Pacific Ocean. Currently, a maximum of 21 operational risers are allowed, a restriction dictated by the low diurnal dry weather flow rate ( $7\pm$  mgd) on the westside and the requirement to maintain adequate port velocities to prevent biofouling of the SWOO. The current operation with 21 SWOO risers open is expected to continue until the eventual construction and activation of a cross-town conveyor which will contribute a minimum of 25-30 mgd of dry weather flow to SWOO, thus supporting activation of all 85 SWOO risers.

Restricting the number of active SWOO risers to 21 has affected the hydraulic capacity of the SWOO. The system curves in Figure 2 show the hydraulic grade line (HGL) in the SWOO junction structure or headworks as a function of SWOO discharge and the number of risers open. Each curve corresponds to a different number of SWOO risers as indicated. The fewer the risers open, the higher the HGL in the SWOO junction structure for the same flow rate and vice versa. The HGL in the SWOO junction structure governs the upstream hydraulics of both the decanted flow conveyance system and the OWPCP effluent system. The critical HGL in the SWOO junction structure is at elevation +6 feet which corresponds to the design tide level and the free discharge of OWPCP effluent to SWOO. With 21 risers open, the safe discharge to SWOO from the entire westside system is limited to  $160\pm$  mgd (see Figure 2). Attempting to force more flow through the existing SWOO system will result in flooding of the OWPCP. When all 85 risers are open, discharge of 160 mgd from Oceanside and 110 mgd from Bayside is possible without adding pumping capacity.

The primary conclusion reached from the preceding discussion is that, prior to the construction of a cross-town conveyor, the SWOO hydraulics, as impacted by the 21 allowable active risers, limit the offshore discharge of westside flows to 160 mgd, including decanted flow and OWPCP effluent. This limitations favors Richmond and Lake Merced facilities with relatively lower withdrawal rates and larger storage structures. These findings were taken into consideration in the development of alternatives for Richmond and Lake Merced, discussed in subsequent sections of this report.

### IMPACT OF CROSS-TOWN FLOWS ON WESTSIDE

The discharge of treated bayside flows to the Pacific Ocean via the Southwest Ocean Outfall (SWOO) would support the opening of all 85 SWOO risers, thus removing one of the major limitations that currently affect the hydraulics of the westside system. With all 85 risers open, the hydraulic capacity of SWOO would be used to its maximum, within the limits allowed by the remaining westside elements.

Table 1 represents hydraulic information pertaining to alternative cross-town flow rates and their impact on the westside system and its operation. The last column in Table 1 outlines possible actions that could be taken to offset those impacts. In all cases, the peak wet weather flow to SWOO from the entire westside system was assumed to be 160 mgd, the maximum rate allowed prior to any cross-town flow with 21 SWOO risers open. Limiting the cross-town flow to 110 mgd, i.e. the peak bayside dry weather flow rate, will have minimal effects on westside operations. Higher cross-town flow rates would adversely affect the westside system, which would require appropriate modifications as outlined in the last column of Table 1.

### METHOD OF ANALYSIS

The hydrologic analysis was performed with the aid of a computer model which simulates wet-weather operations in the entire Westside System including the proposed facilities in Richmond and Lake Merced. The computer model is a mass balance simulation model operating on a base time unit of one hour. One of the main inputs to the model is a 70-year record of historic hourly rainfall which enables the development of long-term statistics on overflows and other flow-related variables. Using watershed areas, runoff coefficients and other pertinent information (see Figure 1), the program transforms rainfall to runoff for each watershed, adds the respective DW flow and routes the combined flows through the network of sewers, storage structures, pump stations and treatment plants according to predetermined algorithms and operating policies. The simulation is continuous, on an hourly basis, over the 70 year period of rainfall data.

**Table 1. Impact of Cross-Town Flows on Westside Operations with 85 SWOO Risers Open.**  
**Control Elevation for OWPCP Effluent is +6' (HGL in SWOO Junction Structure)**

| Option No. | Flow to SWOO (mgd)<br>(85 Risers Open) |                 |               | SWOO Junction Structure HGL |                | Remarks   |
|------------|--|-----------------|---------------|-----------------------------|----------------|---|
|            | From Bayside                           | From Westside   | Total to SWOO | With 10-yr High Tide        | With MHHW Tide |   |
| 1.         | 110                                    | 40 <sup>1</sup> | 150           | 0.5'                        | -1.2'          | <ul style="list-style-type: none"> <li>◦ Applies only to DW Conditions (See #2 for WW)</li> <li>◦ No impact on Westside Operations during DW.</li> </ul>  |
| 2          | 110                                    | 160             | 270           | 6.3'                        | 4.5'           | <ul style="list-style-type: none"> <li>◦ WW version of Option 1.</li> <li>◦ Negligible impact on Westside operations during WW.</li> </ul>  |
| 3          | 210                                    | 160             | 370           | 13.4'                       | 11.5'          | <ul style="list-style-type: none"> <li>◦ Lift OWPCP effluent by 1' to 8' during WW.</li> <li>◦ Static head of decant flow pumps increases by 9'</li> <li>◦ HGL in Vault 3 below ground level (+20')</li> </ul>  |
| 4          | 320                                    | 160             | 480           | 23.6'                       | 21.7'          | <ul style="list-style-type: none"> <li>◦ Lift OWPCP effluent 10' to 17' during WW.</li> <li>◦ Static head of decant flow pumps increases by 16'</li> <li>◦ Pressurize Vault 3, SWOO headworks and 7' pipe</li> <li>◦ Change impellers of decant flow pumps</li> </ul> |
| 5          | 460                                    | 160             | 620           | 40.5'                       | 38.7'          | <ul style="list-style-type: none"> <li>◦ Lift OWPCP effluent 27' to 34' during WW.</li> <li>◦ Static head of decant flow pumps increases by 33'</li> <li>◦ Pressurize Vault 3, SWOO headworks and 7' pipe</li> <li>◦ Change impellers of decant flow pumps</li> </ul> |

(1) Peak Westside DW Flow

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When the simulation is completed, the program prints, among other information, average annual values of the number, volume and duration of overflows from each T/S facility. More than one simulation may be required for each alternative. For a given storage volume, the simulations are repeated while varying the withdrawal rate until the desired overflow frequency, i.e. 8 overflows per year, is achieved.

Operating policies and hydraulic control algorithms pertaining to each of the alternatives analysed were programmed into the computer model before proceeding with the analysis. Due to its higher relative elevation, the Richmond area is hydraulically independent of the remaining existing and future westside facilities. Therefore storage-withdrawal rate combinations for Richmond were developed first. Subsequently, the analysis was extended to Lake Merced by simulating the entire westside system. Lake Merced facility sizes were developed for each Richmond alternative (see the following section for facility sizes).

### SCENARIOS AND ALTERNATIVES

The general approach to the control of combined sewer flows is to attenuate these flows by building storage and withdrawal facilities of the sizes required to achieve the desired overflow reduction and at the same time, maintain compatibility with existing and future facilities and operations.

The proposed facilities in Richmond and Lake Merced will each include some kind of in-line or off-line storage structure and an outflow component in the form of a pump station/force main arrangement or a gravity flow conduit. Because of the elevation of the Richmond drainage area in relation to the existing Westside Transport (WST) storage facility, outflows from Richmond will, logically, be conveyed to the WST box, whereas Lake Merced outflow can be discharged either into the WST box or directly to SWOO, the latter following local decanting.

In order to establish a basis for the development and analysis of alternatives, an array of viable facility sizes was selected and analyzed in detail. In the case of Richmond, the following facility options were selected, following a series of computer simulations to establish the relationship between storage volume and withdrawal rate.

| <u>Richmond Storage</u><br><u>(Million Gallons)</u> | <u>Richmond Outflow Rate</u><br><u>(Million Gallons Per Day)</u> |
|---|--|
| 12.0  | 40   |
| 9.5   | 51   |
| 7.3   | 65   |

Subsequently, seven Richmond alternatives denoted by R-1, R-2, R-3, R-4, R-5 and R-6A, R-6B were developed and recommended for initial study. The seven alternatives do not specify exact facility sizes but address scenario type, i.e., pumping versus gravity outflow, basin or tunnel configuration, location and alignment. In the case of a gravity outflow system in Richmond, it will be necessary to provide some kind of downstream control to regulate the flow to the WST box as required.

For each of the three Richmond Facility options described above, i.e., 12, 9.5 and 7.3 million gallons of storage, matching sizes of Lake Merced Facilities were determined such that the average number of overflows in Richmond, WST and Lake Merced, respectively, will not exceed eight times per year. In so doing, it was also necessary to determine corresponding Westside Pump Station (WSPS) flow rates to ensure compatibility of the proposed facilities in Richmond and Lake Merced with Westside Facilities, (WST, WSPS, OWPCP) and operations.

Lake Merced scenarios include the following:

1. Storage basin and pump station with force main to the WST box.
2. Storage basin, decanting chamber and pump station with force main to SWOO.
3. Low level tunnel, with the entire tunnel storage below +6 feet, connected to the WST box via a smaller pipe for controlled outflow purposes.

Different alignments of the above scenarios have resulted in the development of a number of Lake Merced Alternatives for initial study purposes. Regardless of their location or alignment, the various options of Lake Merced Facilities must conform to the three Richmond Facility options described earlier and the existing Westside Facilities (WST and WSPS), and the Oceanside Water Pollution Control Plant (OWPCP) currently under design.

### DISCUSSION OF RESULTS

Each of the alternatives shown in Table 2 is capable of achieving the desired results. However, based on previous investigations, group B with Richmond storage at 9.5 MG and a withdrawal rate of 51 mgd seems to provide maximum flexibility in choosing the most viable Richmond alternative. Similarly, all Lake Merced alternatives under group B appear to be viable without any extremes in terms of storage volume and withdrawal rate requirements. Therefore, it seems appropriate to confine subsequent evaluations and discussions to the alternatives under group B.

An important decision to be made involves the choice between a storage basin/pump station scenario with or without decanting and a gravity system or tunnel scenario. Obviously, a tunnel scenario has no pumps, no moving parts hence no operating policy and is almost operation and maintenance free. Additionally, an inland tunnel connecting the Lake Merced trunk sewer system to the Westside Transport (WST) box improves the hydraulics of the lower Lake Merced sewer system which now seems to be inadequate. An inland tunnel scenario is therefore recommended. A shoreline tunnel aggravates upstream hydraulics in an already inadequate system and should be avoided.

**TABLE 2. RICHMOND AND LAKE MERCED ALTERNATIVES. WITHDRAWAL RATES (Q) AND STORAGE (S) REQUIREMENTS**

| ID.<br>NO.       | RICHMOND<br>TRANSPORT |     | LAKE MERCED TRANSPORT FACILITIES |                     | DECANTED<br>FLOW IN<br>WST (MGD) |
|------------------|-----------------------|-----|----------------------------------|---------------------|----------------------------------|
|                  | S(MG)                 | Q   | STORAGE (MG)                     | WITHDRAWAL (MGD)    |                                  |
|                  | (1)                   | (2) | (3)                              | (4)                 | (5) <sup>2</sup>                 |
| A.1              | 12.0                  | 40  | 9.2 MG BASIN                     | 25 MGD PUMP TO WST  | 105 TO SWOO                      |
| A.2              | 12.0                  | 40  | 11.0 MG BASIN<br>+DECANT         | 25 MGD PUMP TO SWOO | 80 TO SWOO                       |
| A.3              | 12.0                  | 40  | 9.5 MG TUNNEL <sup>1</sup>       | N/A: GRAVITY TO WST | 105 TO SWOO                      |
| B.1              | 9.5                   | 51  | 9.2 MGD BASIN                    | 25 MGD PUMP TO WST  | 112 TO SWOO                      |
| B.2              | 9.5                   | 51  | 11.0 MG BASIN<br>+DECANT         | 25 MGD PUMP TO SWOO | 87 TO SWOO                       |
| B.3 <sup>3</sup> | 9.5                   | 51  | 9.5 MGD TUNNEL <sup>1</sup>      | N/A: GRAVITY TO WST | 112 TO SWOO                      |
| C.1              | 7.2                   | 65  | 9.2 MG BASIN                     | 25 MGD PUMP TO WST  | 118 TO SWOO                      |
| C.2              | 7.3                   | 65  | 11.0 MG BASIN<br>+DECANT         | 25 MGD PUMP TO SWOO | 93 TO SWOO                       |
| C.3              | 7.3                   | 65  | 13.2 MG TUNNEL <sup>1</sup>      | N/A: GRAVITY TO WST | 110 TO SWOO                      |

<sup>1</sup>The entire tunnel storage must be below elevation +6 ft. In the SHORELINE tunnel alternative, the tunnel volumes shown in the table include approximately 1.5 MG of upstream sewer storage below elevation +6 ft., i.e. net additional SHORELINE tunnel storage is 1.5 MG less than that shown in the Table.

<sup>2</sup>The decanted flow rates shown in Column 5 apply to the existing system with RSWPCP at 45 mgd. These flow rates will slightly decrease after the construction of the OWPCP. Nevertheless, the total flow to SWOO i.e. decanted flow plus OWPCP effluent will not exceed 160 mgd.

<sup>3</sup>Apparent Best Alternative

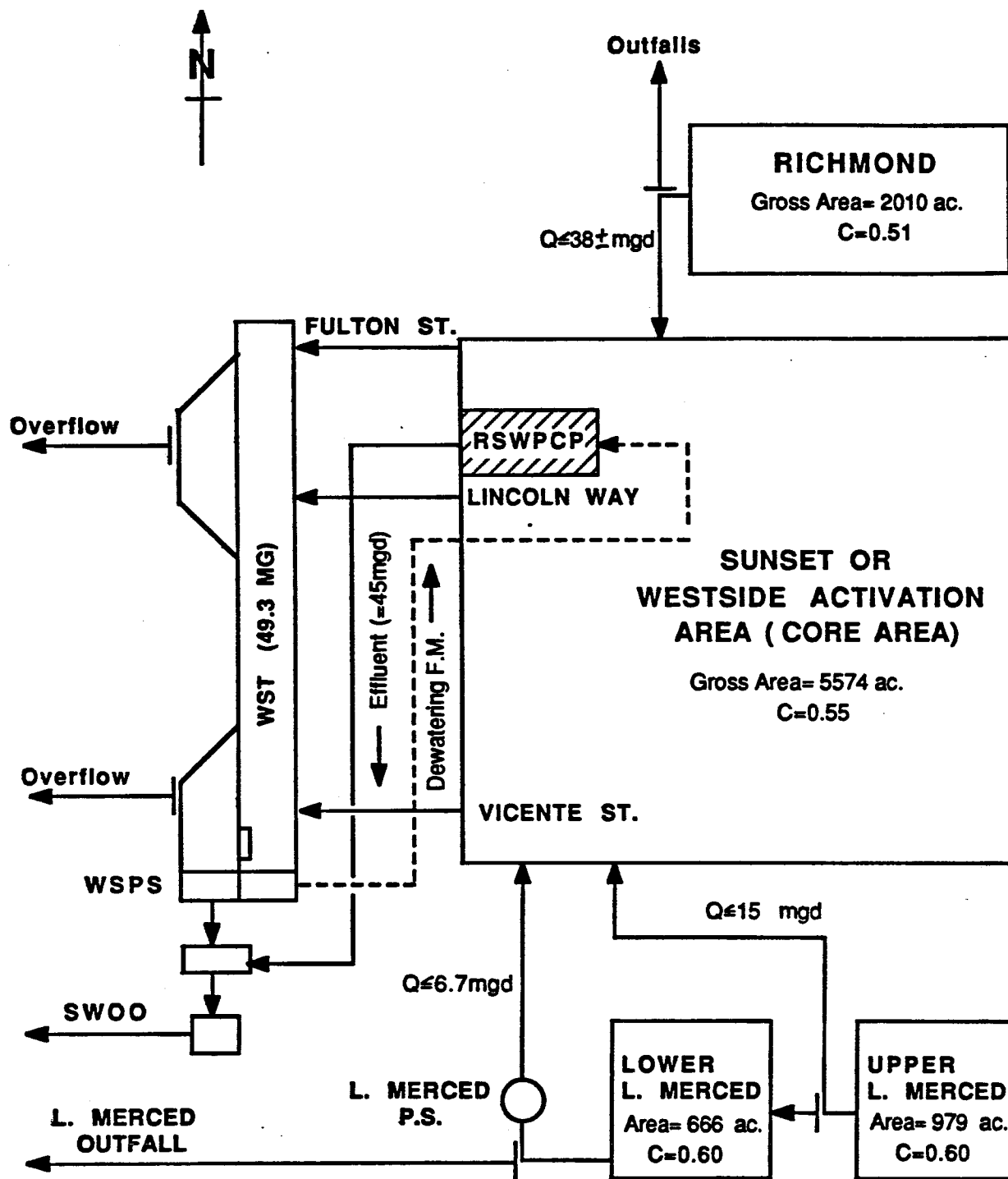
An inland tunnel would start at the existing Lake Merced pump station where it would be connected to the Lake Merced trunk sewer system by a diversion/control structure. At the downstream end, the tunnel would connect to the easterly chamber of the WST box via a 5' to 5.5' diameter pipe. Combined flow from Lake Merced would, therefore, mix with combined flow from the remaining westside areas. The three pumps in the easterly sump of the WSPS would be dedicated to pumping flow to the OWPCP. Thus, decanted flow would be pumped to the SWOO only by the four pumps in the westerly sump of the WSPS. These pumps have a maximum pumping capacity of 88 mgd, well below the 112 mgd pumping rate required (see column 5 in Table 2). By placing a fifth pump directly in the westerly box of the WST to pump additional decanted flow at the rate of 25± mgd, the required pumping rate for decanted flow is easily achieved.

Based on the preceding discussion, an inland tunnel scenario seems most appropriate. The storage volume of the tunnel that fits is 9.5 MG. Therefore, depending on the tunnel alignment, i.e. length, the appropriate tunnel diameter can be selected. The westside core system that would evolve after construction of the Richmond and Lake Merced facilities would have the following major operational characteristics.

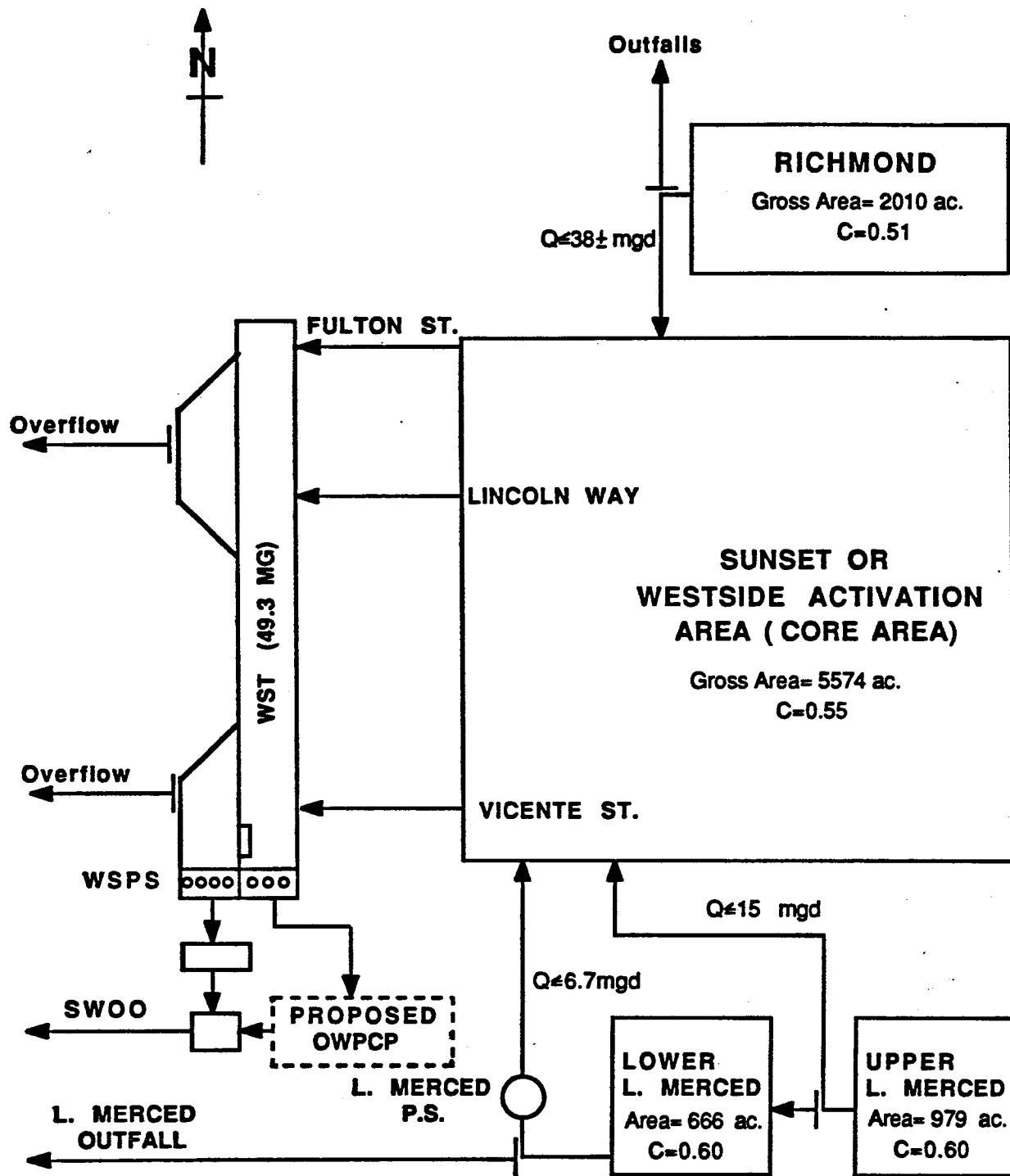
- o Without any cross-town flow to SWOO, 21 open SWOO risers are required. (All 85 SWOO risers must be open should bayside flows be discharged to SWOO via a cross-town conveyor.)
- o The Oceanside Water Pollution Control Plant (OWPCP) with a nominal secondary treatment capacity of 43 mgd will be capable of treating up to 65 mgd during wet weather under high storage level conditions in the WST box.
- o The three-pump easterly sump of the WSPS will be dedicated to the pumping of flows to the OWPCP via a new force main. Pumping to the OWPCP has priority over decanting.
- o The four pumps in the westerly sump of the WSPS plus one additional pump to be installed in the westerly box of the WST just upstream of the WSPS will pump decanted flow to SWOO via the existing conduit system.
- o Effluent from the OWPCP will gravitate to the SWOO headworks where it will combine with the decanted flow prior to discharging into the Pacific Ocean via the open risers in the SWOO. The sum of decanted flow plus OWPCP effluent will not exceed 160 mgd.

- o Lake Merced flows entering the proposed Lake Merced tunnel will be discharged into the easterly Chamber of the WST box via a 5' - 5.5' diameter pipe.
- o During wet weather, when the Lake Merced flow exceeds the transport and storage capacity of the proposed Lake Merced tunnel, the excess flow will be baffled and allowed to spill over a control weir at the upstream end of the tunnel into the existing Lake Merced outfall tunnel for discharge into the Pacific Ocean an average of eight times per year.

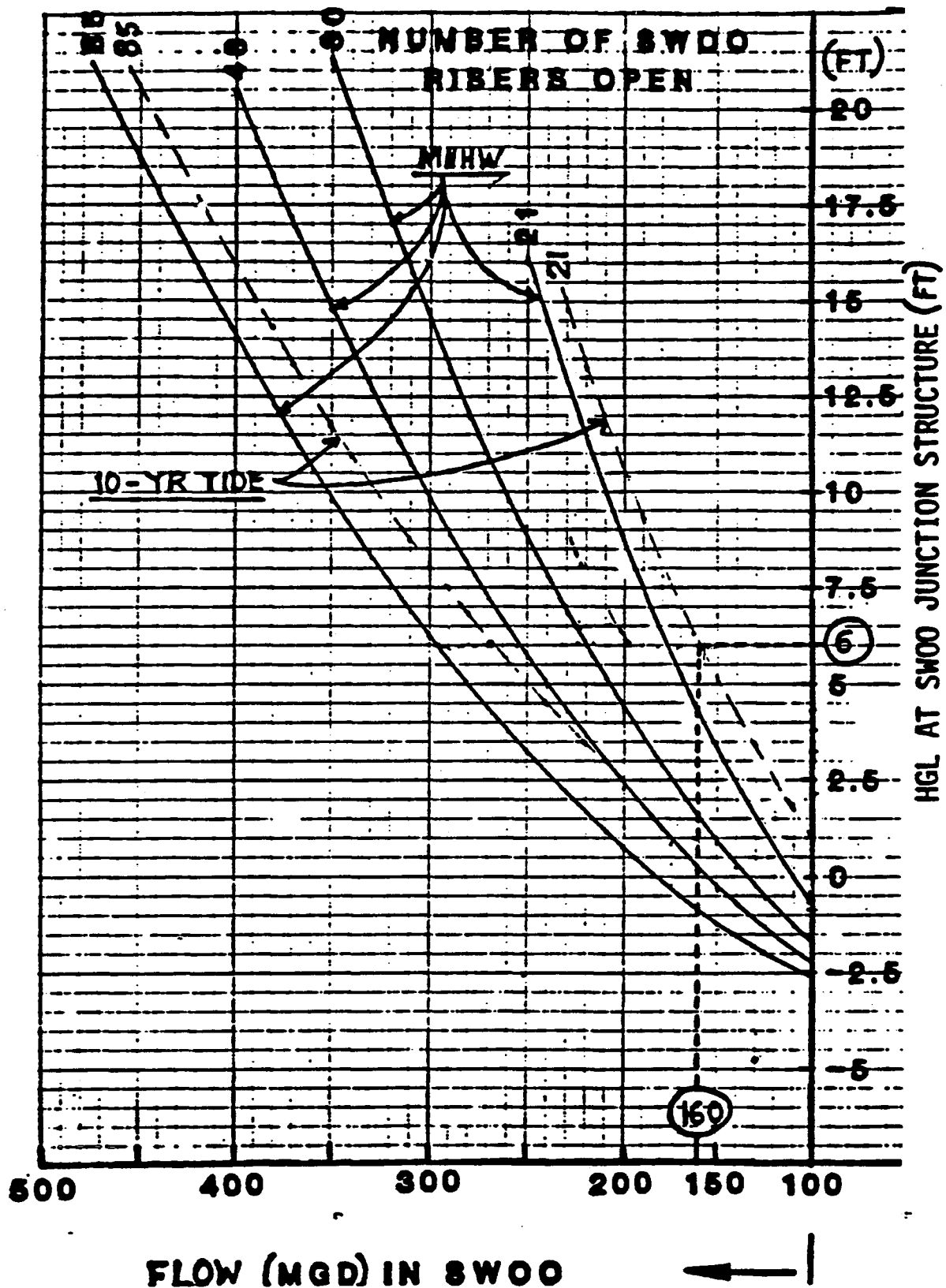




**FIGURE 1. SIMPLIFIED SCHEMATIC OF THE EXISTING WESTSIDE CORE SYSTEM**



**FIGURE 1A. SIMPLIFIED SCHEMATIC OF THE EXISTING WESTSIDE CORE SYSTEM WITH THE OWPCP REPLACING RSWPCP**



**FIGURE 2.** SYSTEM CURVES SHOWING THE HYDRAULIC GRADE LINE (HGL) IN THE SWOO JUNCTION STRUCTURE AS A FUNCTION OF FLOW RATE AND THE NUMBER OF SWOO RISERS OPEN.

**APPENDIX D**

**DETAILED COST ESTIMATES FOR  
FINAL ALTERNATIVES**

**TABLE 1****DETAILED COST ESTIMATE: LM-1**

| <b>NO.</b>   | <b>DESCRIPTION</b>                         | <b>QUANTITY</b>   | <b>UNIT PRICE</b>  | <b>EXTENSION</b>    |
|--------------|--|-------------------|--------------------|---------------------|
| <b>1</b>     | <b>BASIN 35'x30'x1200'</b>                 | <b>---</b>        | <b>Lump Sum</b>    | <b>\$ 9,600,000</b> |
| <b>2</b>     | <b>Connection Structure</b>                | <b>---</b>        | <b>Lump Sum</b>    | <b>29,000</b>       |
| <b>3</b>     | <b>Control Structure</b>                   | <b>---</b>        | <b>Lump Sum</b>    | <b>800,000</b>      |
| <b>4a</b>    | <b>Pump Station 25 MGD<br/>(Structure)</b> | <b>---</b>        | <b>Lump Sum</b>    | <b>3,500,000</b>    |
| <b>4b</b>    | <b>Pump Station<br/>(Mechanical)</b>       | <b>---</b>        | <b>Lump Sum</b>    | <b>1,500,000</b>    |
| <b>5</b>     | <b>Lift Pump</b>                           | <b>---</b>        | <b>Lump Sum</b>    | <b>450,000</b>      |
| <b>6</b>     | <b>Force Main 36"Ø</b>                     | <b>9,000 feet</b> | <b>\$280/ft.</b>   | <b>2,520,000</b>    |
| <b>7</b>     | <b>Air Release Valve</b>                   | <b>2 each</b>     | <b>\$7,000/ea.</b> | <b>14,000</b>       |
| <b>8</b>     | <b>Drain Out</b>                           | <b>1 each</b>     | <b>\$12,000</b>    | <b>12,000</b>       |
| <b>9</b>     | <b>12"Ø Drain<br/>Out Pipe</b>             | <b>70 feet</b>    | <b>\$140/ft.</b>   | <b>10,000</b>       |
| <b>10</b>    | <b>Force Main Connection</b>               | <b>---</b>        | <b>Lump sum</b>    | <b>9,000</b>        |
| <b>11</b>    | <b>Manhole</b>                             | <b>5 each</b>     | <b>\$7,200/ea</b>  | <b>36,000</b>       |
| <b>12</b>    | <b>Flushing System</b>                     | <b>---</b>        | <b>Lump Sum</b>    | <b>40,000</b>       |
| <b>TOTAL</b> |  |                   |                    | <b>\$18,520,000</b> |

**TABLE 2**  
**DETAILED COST ESTIMATE: LM-2**

| NO.          | DESCRIPTION                        | QUANTITY | UNIT PRICE  | EXTENSION           |
|--------------|------------------------------------|----------|-------------|---------------------|
| 1            | Basin 35'x30'x1400'                | ---      | Lump Sum    | \$11,200,000        |
| 2            | Connection Structure               | ---      | Lump Sum    | 27,000              |
| 3            | Control Structure                  | ---      | Lump Sum    | 800,000             |
| 4a           | Pump Station<br>15 MGD (Structure) | ---      | Lump Sum    | 3,500,000           |
| 4b           | Pump Station<br>(Mechanical)       | ---      | Lump Sum    | 1,500,000           |
| 5            | Force Main 36"Ø                    | 6200 ft. | \$280/ft.   | 1,736,000           |
| 6            | Air Release Valve                  | 2 each   | \$7000/ea.  | 14,000              |
| 7            | Drain Out                          | 1 each   | \$12,000    | 12,000              |
| 8            | 12"Ø Drain<br>Out Pipe             | 70 ft.   | \$140/ft.   | 10,000              |
| 9            | Force Main Connection              | ---      | Lump Sum    | 5,000               |
| 10           | Manhole                            | 3 each   | \$7,200/ea. | 22,000              |
| 11           | Flushing System                    | ---      | Lump Sum    | 40,000              |
| 12           | Decant Work                        | ---      | Lump Sum    | 315,000             |
| <b>TOTAL</b> |                                    |          |             | <b>\$19,183,000</b> |

**TABLE 3****DETAILED COST ESTIMATE: LM-3**

| <b>NO.</b>   | <b>DESCRIPTION</b>                        | <b>QUANTITY</b>  | <b>UNIT PRICE</b> | <b>EXTENSION</b>    |
|--------------|---|------------------|-------------------|---------------------|
| <b>1</b>     | <b>Mobilization</b>                       | <b>---</b>       | <b>Lump Sum</b>   | <b>\$ 1,631,000</b> |
| <b>2</b>     | <b>Tunnel Excavation<br/>&amp; Lining</b> | <b>8,600 ft.</b> | <b>2,104/ft.</b>  | <b>18,094,000</b>   |
| <b>3</b>     | <b>Southern Terminus</b>                  | <b>---</b>       | <b>Lump Sum</b>   | <b>321,000</b>      |
| <b>4</b>     | <b>Work Shaft</b>                         | <b>---</b>       | <b>Lump Sum</b>   | <b>688,000</b>      |
| <b>5</b>     | <b>Jacked Pipe 5'Ø</b>                    | <b>117 ft.</b>   | <b>0726/ft</b>    | <b>85,000</b>       |
| <b>6</b>     | <b>Pipe in Shaft</b>                      | <b>---</b>       | <b>Lump Sum</b>   | <b>5,000</b>        |
| <b>7</b>     | <b>Box Sewer Connection</b>               | <b>---</b>       | <b>Lump Sum</b>   | <b>14,000</b>       |
| <b>8</b>     | <b>Pipe in Box Sewer</b>                  | <b>---</b>       | <b>Lump Sum</b>   | <b>80,000</b>       |
| <b>9</b>     | <b>Dewatering of Shafts</b>               | <b>---</b>       | <b>Lump Sum</b>   | <b>37,000</b>       |
| <b>10</b>    | <b>Lift Pump</b>                          | <b>---</b>       | <b>Lump Sum</b>   | <b>450,000</b>      |
| <b>TOTAL</b> |   |                  |                   | <b>\$21,405,000</b> |